Critical Infrastructure Needs on the Northeast Corridor

January 2013

NORTHEAST CORRIDOR
INFRASTRUCTURE AND OPERATIONS ADVISORY COMMISSION

Congress established the Northeast Corridor Infrastructure and Operations Advisory Commission (the Commission) to develop coordinated strategies for improving the Northeast's core rail network in recognition of the inherent challenges of planning, financing, and implementing major infrastructure improvements that cross multiple jurisdictions. The expectation is that by coming together to take collective responsibility for the NEC, these disparate stakeholders will achieve a level of success that far exceeds the potential reach of any individual organization.

The Commission is governed by a board comprised of one member from each of the NEC states (Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania, Delaware, and Maryland) and the District of Columbia; four members from Amtrak; and five members from the U.S. Department of Transportation (DOT). The Commission also includes non-voting representatives from four freight railroads, states with connecting corridors (Maine, New Hampshire, Vermont, Virginia, and North Carolina), and the NEC's largest commuter operator (New York Metropolitan Transportation Authority).

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Introduction

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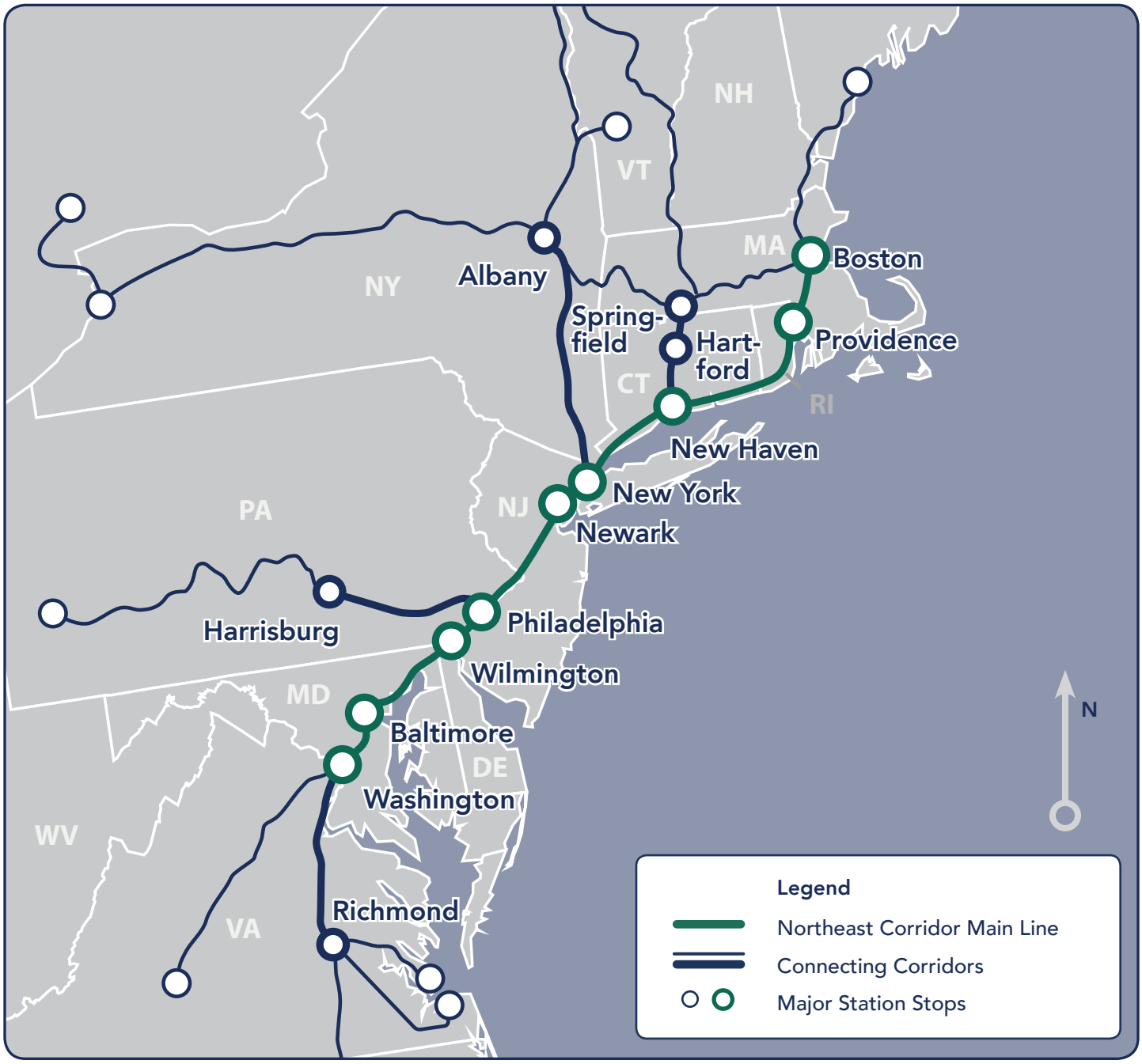
A Time for Action

Demand for rail service in the Northeast Corridor (NEC) is at record levels. Contributing factors to this growth include a relative rebound in population and employment growth in its major urban markets, increasing delays affecting other major transportation options including highways and air travel, and the reliability and convenience of rail in serving core-city markets for both intercity and local travel.

The NEC, however, cannot continue to accommodate this rising demand due to infrastructure that is highly constrained and in need of repair. Hundreds of its bridges and tunnels are now over a century old; major portions of its electric traction power supply system date from the 1930s or earlier; and signal systems rely on decades-old installations. With more than 2,000 trains per day and major segments at or near capacity, operating the NEC leaves little room for error. When problems with these aging

The Northeast Corridor



components do occur, they cause major disruptions with cascading effects over much of the Northeast rail network. Even when these systems function properly, a lack of reserve capacity increases upkeep costs because vital maintenance must be done at night and on weekends to avoid service disruptions during the day. Capacity chokepoints preclude increases in service to accommodate growing demand.

Today, the reality is that after four decades of limited federal, state, and local investment, deferring replacement of key components of the NEC is no longer a sustainable option – infrastructure inherited from past generations can no longer provide the mobility needed to support continued, robust economic growth. New investment is essential to modernize systems, reduce failures, and expand capacity for increased service.

An Issue of Regional and National Significance

The NEC region is home to over 50 million people, or one out of every six Americans.[1] It is the country's economic powerhouse, generating $1 out of every $5 in gross domestic product (GDP).[2] One out of every three Fortune 100 companies has its headquarters in close proximity to the NEC.[3]

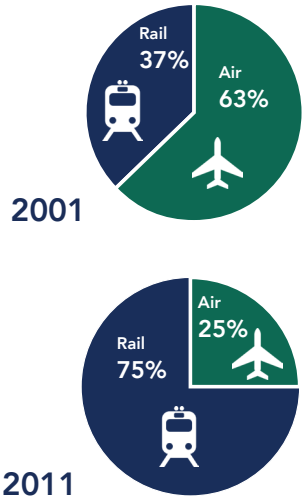
All this activity occurs on less than two percent of the nation's land area. The density that supports this immense productivity, however, also creates congestion challenges for our transportation network. While automobile traffic in the region results in approximately $22 billion per year in lost productivity (2010), bottlenecks at Northeast airports have national repercussions for air traffic.[4] The major airports in New York and Philadelphia are the originating source of half of the nation's flight delays.[5]

The NEC plays a critical role in regional mobility. Despite its challenges, it remains one of the great rail corridors of the world. Every day over 700,000 people, nearly half of all railroad commuters nationally, travel over portions of the NEC main line on one of eight commuter rail services. Over 40,000 intercity rail passengers use Amtrak's various NEC services – trips that might otherwise burden the region's interstate highways or airports. When bad weather strikes and on busy holiday weekends, additional users flock to the rail network to take advantage of its superior dependability. Overall ridership on Amtrak's NEC services has grown 37% since 2000. The NEC also supports significant freight activity. Four private freight railroads utilize some portion of the NEC main line, moving over 350,000 carloads along it every year.

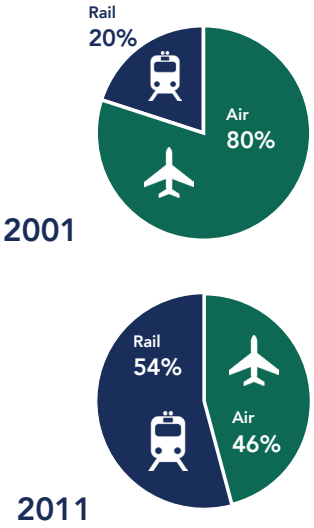
However, growth in the face of aging infrastructure and capacity constraints has caused increased system failure rates and higher congestion, which are negatively impacting the reliability of existing services.

In 2012, Amtrak reports that 90% of its Acela Express trains arrived on time (within 10 minutes of schedule), and the on-time performance of its Northeast Regional trains (a number of which journey off the NEC) is 87%. While these numbers compare favorably with historic NEC experience, reliability lags far behind international standards. Though Japan's high-speed Shinkansen trains enjoy purpose-built, dedicated right-of-way, they

Air/Rail Travel Market Washington, DC to NYC



Air/Rail Travel Market Boston to NYC

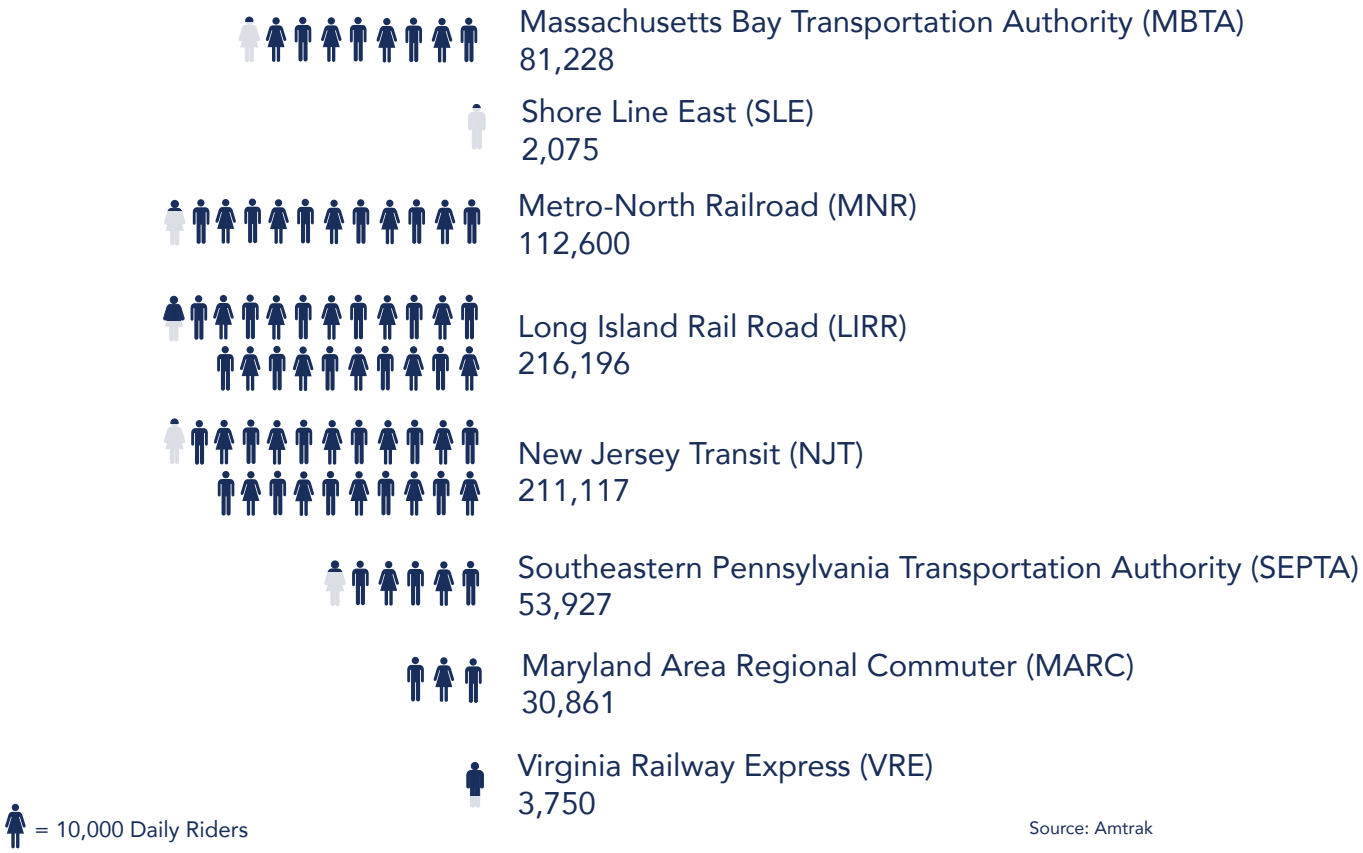


Source: Amtrak

boasted an average arrival time of within 36 seconds of schedule in 2011.[6] According to Amtrak, interference between various types of trains (commuter, intercity, and freight) and track and signal malfunctions are responsible for more than 50% of NEC delays. These challenges affect all services that utilize the NEC. Performance data indicate that, among the eight commuter systems, six see their worst on-time performance on routes that operate on the congested NEC.

Major investment in the Corridor is essential to reduce delays, achieve a state-of-good-repair, and build capacity for growth. In 2010, the NEC Infrastructure Master Plan (Master Plan) estimated that the Corridor required approximately $2.6 billion in annual expenditures over twenty years ($52 billion total) in order to achieve state-of-good-repair and build infrastructure capable of supporting passenger rail demand forecasts for 2030. Investment levels over the past several decades have been critical in supporting the NEC's enviable record of continuous safe operation but have barely covered the costs of normalized replacement of basic components. They fall far short of the levels needed to address repair backlogs and meet future needs.

Average Daily Commuter Rail Ridership on NEC Infrastructure Fiscal Year 2011



Source: Amtrak

Planning Across Agencies and Time Frames

Realizing a bolder vision for the future will require unprecedented collaboration. But comprehensive planning is difficult for a system that spans eight states and the District of Columbia, supports nine passenger rail operators, serves four freight rail operators, and has four separate infrastructure owners. It is also a challenge to ensure that short-term capital projects align with long-term infrastructure and service plans. A key charge for the Commission is to work with its stakeholders to develop strategies for coordinated action.

This document does not represent a plan. Its purpose is to describe the NEC's most critical infrastructure needs as identified by the members of the Commission through a consensus-based process. This report is an informational resource that will complement the ongoing development of integrated plans for the Corridor.

NEC Comprehensive Infrastructure Investment Plan

To define short-term steps in the context of longer-term strategies, the Commission is working closely with Amtrak, the Northeast states, and other railroads to update the findings of the Master Plan through the development of a comprehensive investment plan. This multi-year capital program will focus on projects that must advance in the near term to solve today's challenges while laying a foundation for future growth. Its development includes extensive internal coordination of departments within Amtrak to ensure capital project phasing allows for uninterrupted rail service and corresponds with appropriate workforce development.

The Commission is playing a critical role incorporating the Northeast states and operating railroads in the NEC Comprehensive Infrastructure Investment Plan. Through outreach and a series of regional workshops, the Commission is ensuring all stakeholders have the opportunity to provide revised service goals and forecasts from the Master Plan baseline for integration into the planning process. Coordination is particularly important for non-Amtrak-owned portions of the NEC, such as the New Haven Line, a critical 56-mile section of the NEC owned by the state of Connecticut and the New York MTA, and operated by MTA Metro-North Railroad. Its development will set the framework for an iterative ongoing capital planning process for the NEC.

This comprehensive planning effort will build on the success Amtrak and the Northeast states have had in implementing projects funded by the American Recovery and Reinvestment Act (ARRA), the High-Speed Intercity Passenger Rail (HSIPR) program, the Transportation Investments Generating Economic Recovery (TIGER) program, and other federal and non-federal sources of funding. These recent programs have invested more than $1.2 billion in capital expenditures (see appendix).

NEC FUTURE

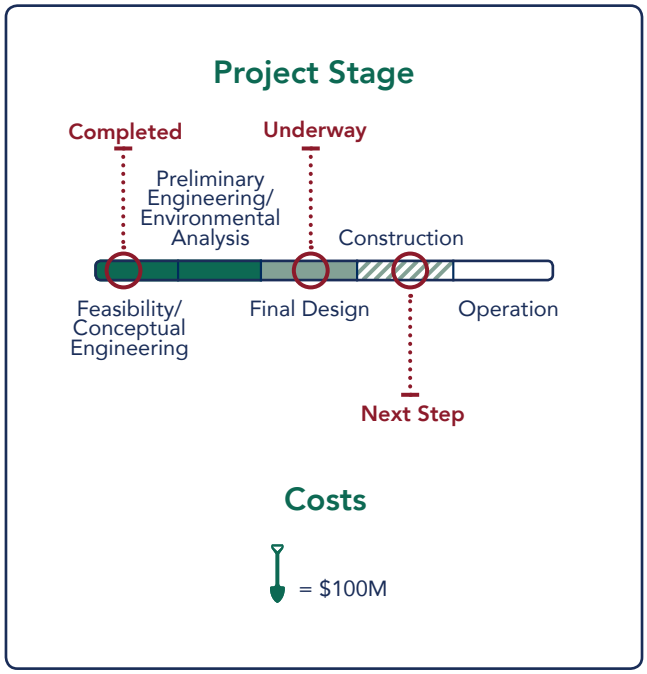
For longer-term growth, the Federal Railroad Administration (FRA), in cooperation with the Commission, the Northeast states, and Amtrak, is undertaking a Passenger Rail Corridor Investment Plan (PRCIP). The NEC FUTURE program includes a Tier 1 Environmental Impact Statement (EIS) and Service Development Plan (SDP) to establish a vision for the NEC through 2040. One of the key goals of the Commission is to unify its members behind a long-term plan and investment strategy for the NEC. The NEC FUTURE process is an essential foundation for this part of the Commission's work.

NEC FUTURE, the NEC Comprehensive Infrastructure Investment Plan, this Critical Infrastructure Needs Report, and the various discrete projects already under development on the NEC should all be considered mutually supportive. While NEC FUTURE's framework for 2040 will not be finalized until 2015, work is already underway to tackle today's most pressing challenges. These projects, as well as those advanced in the NEC Comprehensive Infrastructure Investment Plan, are being designed as to not preclude additional improvements that might be recommended by NEC FUTURE or are being developed in phases such that they can be informed by the outcomes of NEC FUTURE.

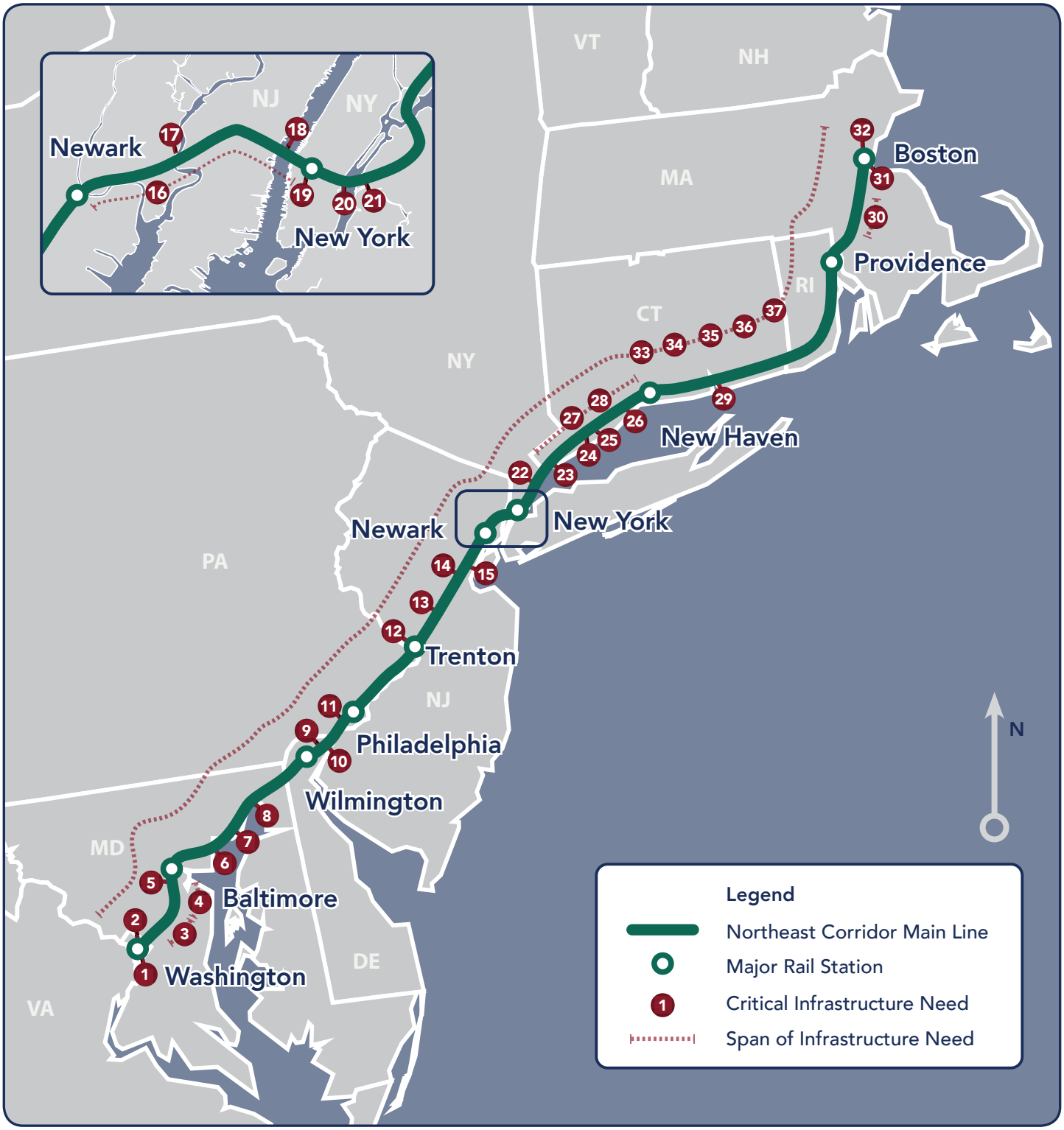
This report highlights the most immediate needs that lack adequate funding to advance solutions through the development process. A very select group of projects lacks only capital funds for construction. Most require financial support to carry them through planning, conceptual engineering, final design, and/or environmental clearance. As a result, the construction cost estimates for addressing most needs in this report are preliminary and order-of-magnitude, subject to change as the design of each project evolves. Unless otherwise noted, these cost figures represent 2012 U.S. Dollars.

While this document describes the underlying needs for the most critical upgrades, the NEC Infrastructure Investment Plan will lay out a feasible and strategically phased approach for funding and implementing projects grounded in a broad ongoing stakeholder participation process. Together, these efforts are essential to renew and enhance the NEC as a world-class, high-performance rail corridor supporting the economic development and international competitiveness of the region and the nation with job creation, improved reliability of existing services, and a foundation for future mobility and economic growth.

Guide to the Report



Approach to New York Penn Station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Major Rail Station
Critical Infrastructure Need
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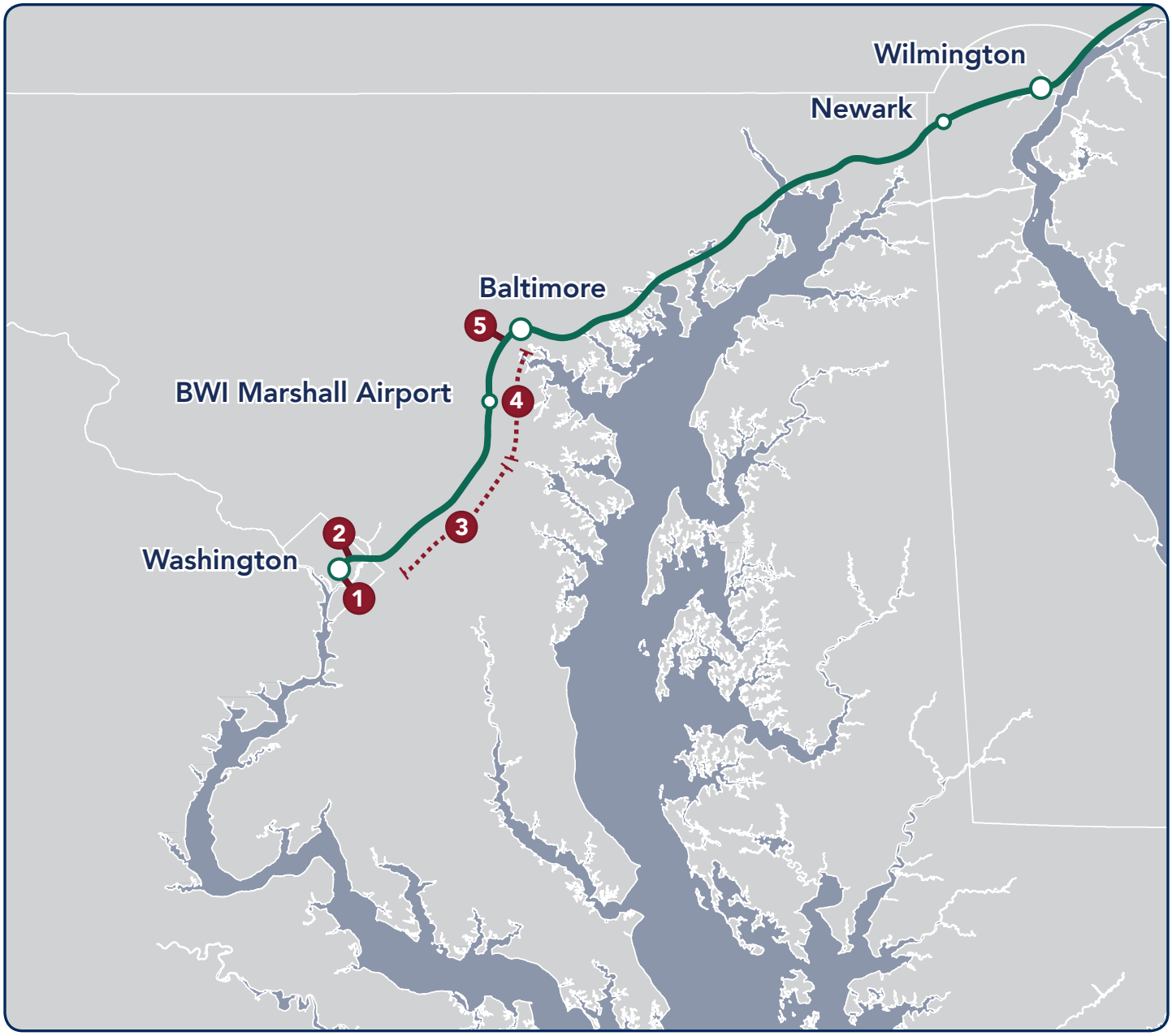
Washington to Baltimore



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2. Train Storage and Service Facilities at Washington Union Station
3. Hanson to Grove Interlocking Fourth Track
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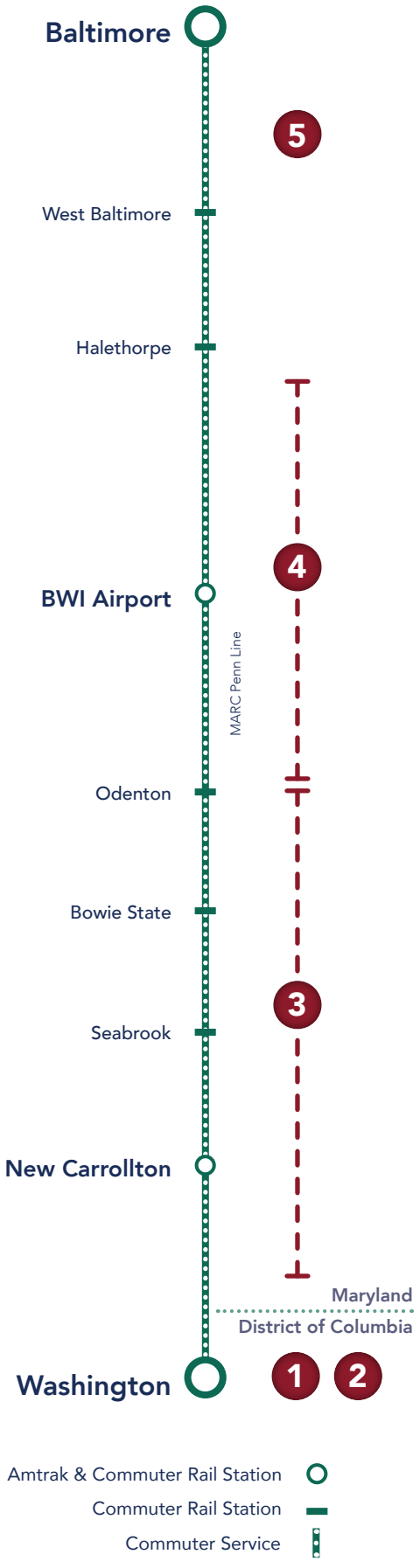
Washington to Baltimore

The segment of the NEC from Washington, DC to Baltimore, MD is approximately 35 miles long and is owned by Amtrak. The segment is primarily three tracks, but narrows to two tracks on the approach to both the Baltimore and Washington stations. Amtrak and Maryland Area Regional Commuter (MARC) operate passenger service with over 130 trains between Baltimore Penn Station and Washington Union Station on an average weekday. CSX Transportation and Norfolk Southern both operate freight services along portions of the segment. In addition, Virginia Railway Express (VRE) operates commuter rail service between Union Station and northern Virginia on lines owned by CSX.

The segment suffers from capacity constraints and reliability challenges due to multiple chokepoints and state-of-good-repair needs. Washington Union Station presents several capacity issues, including crowded conditions for passengers and limited track space for trains. In Baltimore, the NEC travels through the Baltimore & Potomac (B&P) Tunnels, a series of three sequential two-track tunnels that were constructed in 1873 and severely limit train speeds. Overall, the three-track main line configuration limits the fluid movement of local and express services, constraining the growth of commuter and intercity operations on the segment. Analysis produced for the NEC Master Plan demonstrated that tracks through BWI Marshall Airport Station and the approach to Baltimore are currently approaching capacity and, by 2030, the majority of the segment would have demands exceeding capacity.

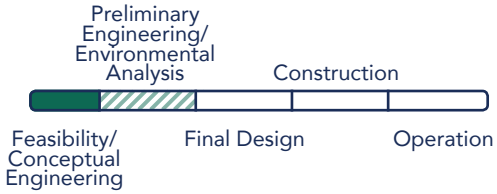
The critical needs along this segment focus on replacing the B&P Tunnel, improving and expanding stations and storage facilities, and building out to a primarily four-track railroad. Investments would support plans to increase intercity and commuter rail service, bolster freight activity, and improve reliability.

Development of the B&P Tunnel replacement project would mitigate a chokepoint, eliminate speed restrictions, and enhance freight access to the port of Baltimore. At key stations, including Washington Union Station and BWI Marshall Airport Station, investments would support the reconfiguration and expansion of station tracks and boarding platforms to accommodate higher levels of service and to improve the passenger experience for both intercity and commuter users. Investments incrementally extending the segment's currently short stretch of four-track railroad south of Baltimore would add line-haul capacity and rail storage yard work just north of Washington Union Station would reduce capacity pressures at the nearby terminal and provide opportunities for increases in service.



1 Washington Union Station Improvements

M. Donnelly



Early Phase Design and Construction Cost:

$315M

Overview: Washington Union Station is the second-busiest station in the Amtrak system and is owned by the Union Station Redevelopment Corporation. In addition to serving Amtrak, MARC, and VRE, the station is a primary intermodal hub for intercity bus service and is the busiest station on the WMATA Metrorail transit system. On an average weekday, the station serves as many as 100,000 travelers, including approximately 8,000 Amtrak and commuter rail riders during each rush hour.

The popularity of Union Station has led to congestion problems for both trains and passengers. Inside the station house, passengers waiting for trains form notoriously long lines that snake through the passenger concourse, creating pedestrian traffic jams, and increasing the chaos of the rush-hour commute. The station's tracks and platforms are over capacity, handling over 150 Amtrak, MARC, and VRE trains each weekday. The station's narrow platforms cause serious overcrowding and several platforms are low-level, which require passengers with luggage to climb car steps to board their train and are not compliant with the level-boarding requirements of the American with Disabilities Act (ADA).

In July 2012, Amtrak released the Union Station Master Plan, prepared in partnership with commuter railroads and local stakeholders. It provides a long-term, multi-phased vision for increased capacity with additional tracks and wider all high-level platforms; new amenities for passengers including sweeping modern concourses and retail spaces; and large-scale real estate development above the station's tracks.

Although much work remains to be done to further refine the master plan and create the necessary public-private partnerships and funding structures, approximately $315 million would fund early action items at Washington Union Station, including relocating facilities to make room for the re-installation of two tracks; beginning preliminary engineering and design for the reconstruction of the platforms and concourse that facilitate Amtrak and commuter run-through service to Virginia and points south; and providing immediate improvements and expansion to the existing waiting areas for passengers.

These investments are intended to add much needed capacity and relieve congestion inside the station, while laying the foundation the longer-term implementation of the Union Station Master Plan.

2 Train Storage and Service Facilities at Washington Union Station

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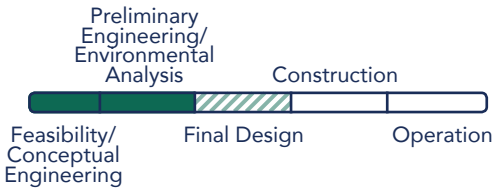


Order-of-Magnitude Cost:

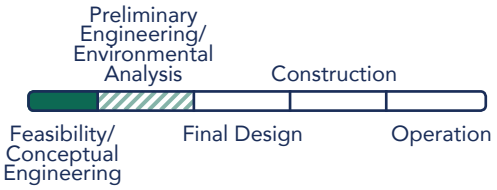
$550M

Overview: At Washington Union Station, Amtrak, VRE, and MARC all store trains at three adjoining yards just north of the station. The largest, Ivy City Yard, is used primarily by Amtrak as its main storage, maintenance, and high-speed rail service and inspection (S&I) facility at Union Station. Coach Yard, located just south of Ivy City, is also used for storage by Amtrak as well as VRE, while the smaller West Yard is used primarily for MARC storage. These storage and maintenance facilities operate near capacity, with Ivy City alone serving the 22 Amtrak trains that begin service each day in Washington. Due to lack of storage capacity, MARC and VRE often store trains mid-day on Union Station terminal tracks, eating up platform space badly needed for passenger service.

MARC is currently constructing "Wedge Yard" to create new daytime storage space adjacent to Coach Yard. Amtrak proposes to renovate Ivy City, including expansion of its S&I facility, to accommodate potential increases in service and train fleets. Amtrak expects to begin an Ivy City master plan to develop conceptual designs for its long-term storage and maintenance needs at Washington Union Station and to support long-term plans to expand NEC service.

3 Hanson to Grove Interlocking Fourth Track

Gary Pancavage



Order-of-Magnitude Cost:

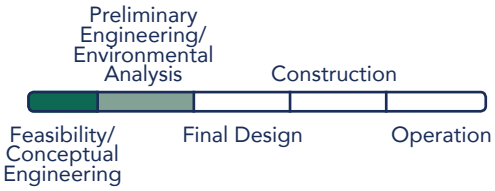
$400M

Overview: Unlike the typical four-track configuration of the NEC between Delaware and Connecticut, Washington to Baltimore consists of only two or three main line tracks. This arrangement often forces express trains into a queue behind locals, slowing service and creating some of the worst recurrent delays on the Corridor. To address this issue, Amtrak and the state of Maryland intend to design and construct a predominantly four-track configuration between Washington and Baltimore.

Proposed investments would construct a fourth track and upgrade the existing third track along a 16-mile segment from a new Hanson Interlocking at Landover, MD to Grove Interlocking, north of Odenton. Improvements may include additional track and commuter platforms at New Carrollton, a major MARC and Amtrak intermodal station with a connection to the Washington Metro.

This section of the NEC is currently operating at over 75% of its practical capacity with over 120 daily Amtrak and MARC trains, as well as freight traffic. Its current configuration will be unable to support future increases in service by all operators. A fourth track would expand capacity and reduce congestion by enabling express and local trains to operate simultaneously in both directions.

4 BWI Marshall Airport Station Improvements and Fourth Track

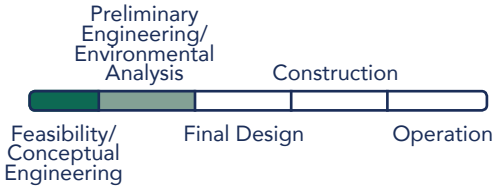


Order-of-Magnitude Cost:

Overview: BWI Marshall Airport rail station is a key intermodal hub on the NEC, serving over 5,000 daily Amtrak and MARC riders and providing connections to domestic and international flights. Although three tracks pass through the station, it has only two platforms serving each of the outermost tracks. These platform tracks are in high demand as many express commuter and intercity trains make stops at this busy station. To access platforms, trains must cross over to the local tracks, which lowers speeds, adds travel time, and creates a bottleneck that limits capacity on the segment and can cause delays for both local and express services.

The state of Maryland and Amtrak aim to dramatically improve the functionality and passenger experience at BWI Marshall Airport Station while expanding the track capacity of the surrounding section of the Corridor. Proposed investments would construct a fourth track along a nine-mile stretch of the NEC from Grove Interlocking, south of BWI Marshall Airport, to Winans Interlocking at Halethorpe, MD. Improvements would include track upgrades north to Bridge Interlocking on the approach to Baltimore's B&P Tunnels. With a Hanson to Grove Interlocking fourth track expansion, this project would help complete a full four-track railroad from Baltimore to just outside Washington. At BWI Marshall Airport Station, planned investments would include the construction of two new center-island platforms, enabling trains to make stops on all four tracks. These improvements would enable MARC and Amtrak to expand service while reducing delays. Plans also call for a new, larger station building to better handle the growing number of passengers and to upgrade the experience of using the station. In 2010, Maryland won a $9.4 million HSIPR grant to complete preliminary engineering and environmental analysis of both the fourth track and the station improvements.

5 Baltimore & Potomac Tunnels



Order-of-Magnitude Cost:

Overview: Baltimore's B&P Tunnels are some of the oldest structural assets on the Corridor and a major capacity bottleneck for both passenger and freight trains. The tunnels were constructed in 1873 – just eight years after the end of the Civil War. A series of three narrow profile tunnels in a more than one-mile stretch, they were originally constructed out of brick and stone masonry, though repairs through the years have introduced additional building materials. With just two tracks, the B&P Tunnels west of Baltimore Penn Station and the Union Tunnel to the east force the NEC to constrict down from four tracks as it passes through downtown Baltimore. Due to its tight curvature and aged structural conditions, the tunnel limits train speeds to 30 mph – down from 60 mph or higher on its approach tracks – and due to its height, the tunnel precludes the use of double-stack freight cars. The B&P Tunnels underwent rehabilitation in the 1980s, but that effort was not intended to be a permanent fix and the tunnels continue to require ongoing maintenance. High saturation of water in the soil beneath the tunnels, for example, causes its aging floor slabs to sink, forcing Amtrak to repeatedly make repairs.

In 2010, Maryland was awarded a $60 million HSIPR grant to complete preliminary engineering and environmental review of options to augment or replace the B&P Tunnels. While the alignment and design of any new tunnel is yet to be determined, planning will consider options for supporting higher-speed train service and creating separate routes for passenger and freight trains through Baltimore. New tunnels could free the existing tunnels for renewal, ultimately for additional capacity, and make Amtrak and MARC less susceptible to maintenance-related delays.

Washington Union Station

D. B. King

Baltimore to Philadelphia

6 Gunpowder River Bridge Replacement

7 Bush River Bridge Replacement

8 Susquehanna River Bridge Replacement

9 Wilmington Third Track and New Brandywine River Bridge

10 Bellevue Flyover

11 Philadelphia Interlocking Flyover

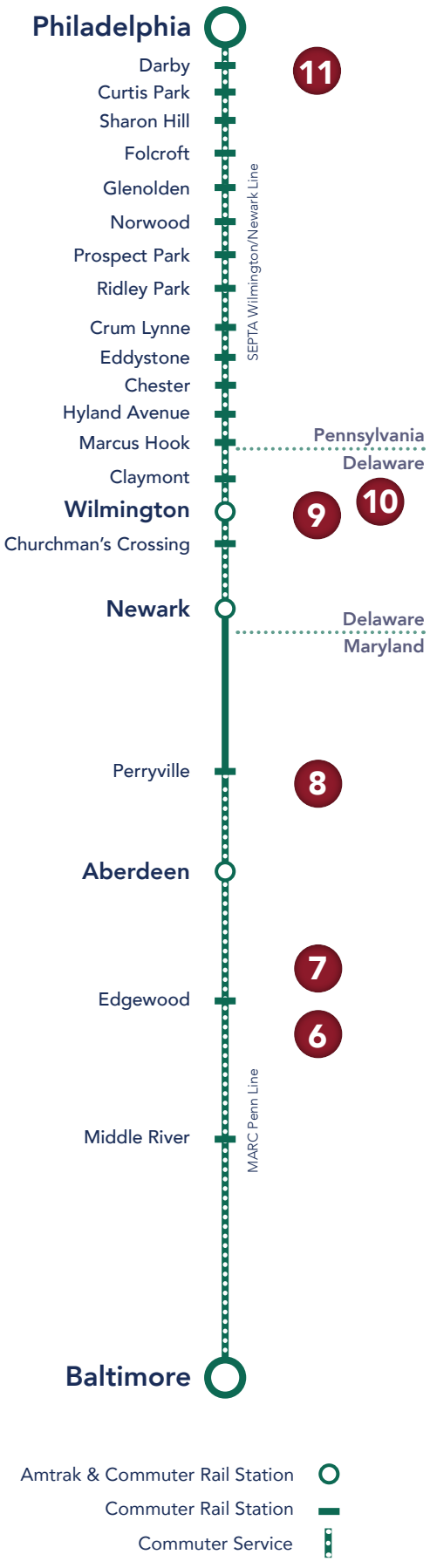
Baltimore to Philadelphia

The NEC from Baltimore, MD to Philadelphia, PA includes major capacity bottlenecks and some of the oldest major bridge infrastructure currently in operation, as well as its highest levels of freight activity. The segment is 95 miles long and owned entirely by Amtrak. Two commuter agencies share passenger service territory with Amtrak, one at each end of the segment. CSX and Norfolk Southern both provide freight service on certain stretches, providing critical access to the ports of Baltimore and Wilmington. At the southern end, MARC operates Penn Line service between Baltimore and Perryville, MD for over 5,000 daily riders. At the northern end, the Southeastern Pennsylvania Transportation Authority (SEPTA) operates its Wilmington/Newark Line between Philadelphia and Newark, DE, for over 9,000 daily riders. SEPTA's Airport Line from Philadelphia International Airport joins the NEC for a short segment before diverging onto SEPTA's own alignment serving 30th Street Station and Center City Philadelphia.

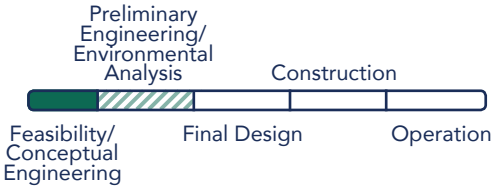
The segment's current infrastructure is not only inadequate for the complex operations it supports today, but will be unable to support the planned growth of passenger and freight service in the future. Amtrak, MARC, and SEPTA all plan to add trains to the NEC, including a proposal by MARC, outlined in the NEC Master Plan, to extend its service beyond Perryville to Newark, DE. Tracks in Baltimore and Wilmington are already operating at over 75% capacity and, according to the Master Plan, will reach and exceed capacity by 2030.

Aging infrastructure is a key challenge. In northern Maryland, the NEC relies on three major bridges – each a century old and beyond its design life – to carry over 90 passenger trains and roughly a dozen freight trains each day over the Bush, Gunpowder, and Susquehanna Rivers. Each bridge forces the NEC to constrict from four or three tracks down to two, limiting the number of passenger and freight trains on the line and making all services prone to delays. All three bridges are too low to allow large ships to pass underneath. Two of them maintain elaborate antiquated procedures for opening and closing a span for marine traffic.

Proposed investments on this segment focus on modernizing the NEC to achieve state-of-good-repair and support future growth in train service. In addition to the three highly visible bridge replacement projects, investments in less visible work, like interlocking improvements, would ensure reliable train service and unlock additional capacity.



6 Gunpowder River Bridge Replacement

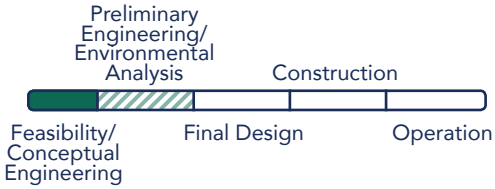


Order-of-Magnitude Cost:

Overview: The Gunpowder River Bridge, approximately one-mile long, carries Amtrak, MARC, and Norfolk Southern freight trains over a broad estuary connecting Chase and Joppa, MD. Among the NEC's three major bridges in Maryland, Gunpowder is the only one that does not open for boats. The bridge was completed in 1913 and many of its components have badly deteriorated, increasing maintenance costs for Amtrak. Gunpowder's two tracks restrict capacity on the NEC and result in freight trains, which rely on the bridge to cross the river, operating only at night when Amtrak and MARC trains are not running.

To address these issues, the state of Maryland and Amtrak are considering options for replacing Gunpowder with a higher-capacity bridge that would support increased service and reliability for Amtrak, MARC, and freight service. Plans will consider options that would separate freight and passenger trains, enabling both to run at all times of day.

7 Bush River Bridge Replacement

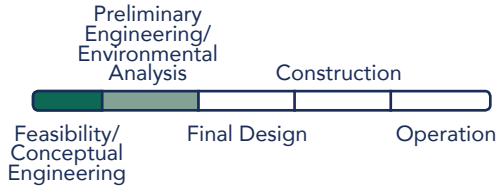


Order-of-Magnitude Cost:

Overview: Completed in 1913, the Bush River Bridge, approximately one half-mile long, connects Edgewood and Perryman, MD. The bridge sits on the busiest segment for freight trains on the entire NEC. The current two-track bridge requires extensive ongoing maintenance, undermining service reliability. During the summer months, a crew of over 20 workers must be assembled to open the bridge for passing boats. Workers manually unbolt the tracks and use a hand crank to open and close the overhead power supply catenary wires like window curtains. During an opening in 2012, the bridge failed to close, delaying all Amtrak trains between New York and Washington for ten hours.

The state of Maryland and Amtrak are planning to replace Bush River Bridge with a new crossing that could provide additional capacity for both passenger service and freight activity. Plans will consider options to construct a new bridge high enough to allow boats to pass below without the need to open the bridge, which would greatly increase reliability for both boats and train riders.

8 Susquehanna River Bridge Replacement



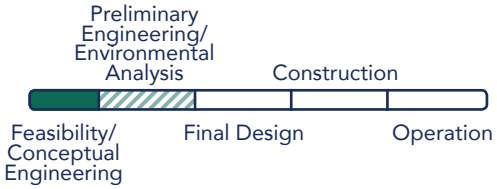
Order-of-Magnitude Cost:

Overview: The Susquehanna River Bridge is the longest movable bridge on the entire NEC, approximately three quarters of a mile long. Completed in 1906, the bridge connects Havre de Grace and Perryville, MD, offering riders stunning views of the Chesapeake Bay.

Of the three major bridges in Maryland, the Susquehanna River Bridge is perhaps the worst bottleneck and arguably the most badly in need of replacement. The bridge constricts the NEC down to two tracks and restricts speeds to 90 mph in an otherwise 120-mph territory due to its design and aging components that cannot support faster trains. Susquehanna is required to open approximately a dozen times per year for boats to pass, but its current design is not suited for the task. A crew of over 30 workers is required to manually open the bridge, essentially de-constructing and re-constructing the railroad each time. The process of opening Susquehanna is much more expensive than opening a modern-day movable bridge, which would require just one bridge operator.

The state of Maryland and Amtrak are planning to replace Susquehanna. In 2011, the state was awarded a $22-million HSIPR grant to initiate preliminary engineering and environmental review of new bridge facilities. Plans may include a new two-track fixed bridge, serving primarily passengers trains, that would be high enough to let boats pass without opening and a second two-track bridge that would serve freight trains and other passenger service. The design of the second bridge would be coordinated with existing freight users. Investments in new bridge infrastructure over the Susquehanna would greatly increase speeds for Amtrak and MARC trains, improve reliability, lower operating costs, and support increased service for all passenger and freight operators.

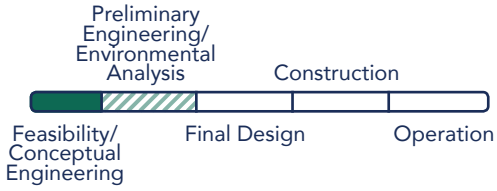
9 Wilmington Third Track & New Brandywine River Bridge



Order-of-Magnitude Cost:

Overview: Wilmington Station is the busiest rail station in the state of Delaware, serving approximately 4,000 Amtrak and SEPTA passengers daily. To the north of the station, the NEC main line passes through a short two-track chokepoint. This congested bottleneck includes the Brandywine River Bridge, a small aging open deck bridge that connects downtown and the north side of Wilmington. To improve service and ease congestion for Amtrak and SEPTA – and unlock future growth in service – the state of Delaware intends to construct a third track through the area. This investment would result in a full three-track railroad through the entire state of Delaware following completion of an ongoing $53-million third-track project south of Wilmington funded in part through a $13.3 million HSIPR grant.

10 Bellevue Flyover

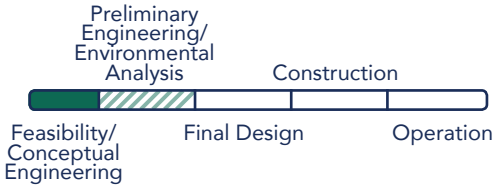


Order-of-Magnitude Cost:

Overview: Bell Interlocking is located just north of Wilmington where the NEC serves Amtrak, SEPTA, and Norfolk Southern. The interlocking's layout governs the converging movements of intercity, commuter, and freight traffic along a broad curve of the Delaware River. Its current configuration is a legacy of the Pennsylvania Railroad's heavy freight service at this location and is now obsolete to support current operations.

The current layout moves all northbound freight and some SEPTA Wilmington/Newark Line trains via an underpass to the inner tracks of the NEC, which elsewhere serve express commuter and intercity trains. Conversely, the current layout moves all northbound Amtrak trains via a flyover to the outer track, which elsewhere serve freight and local commuter trains. Farther north, at nearby at-grade Holly Interlocking, local commuter trains switch back to the outer tracks so they can serve commuter stations and Amtrak trains switch to the inner express tracks. These necessary but conflicting movements lower speeds and make trains prone to delay. Investments in Bell would reconfigure the interlocking and the flyover to separate SEPTA and freight from Amtrak's intercity operations.

11 Philadelphia Interlocking Flyover



Order-of-Magnitude Cost:

$150M

Overview: Approaching Philadelphia from the south, intercity, commuter, and freight trains reach a diversion point at Phil Interlocking. Amtrak trains remain on the NEC main line to serve 30th Street Station's below-ground station platforms. Commuter trains divert off tracks to the west that serve SEPTA's upper-level 30th Street Station concourse. Freight trains divert off tracks to the east that fly over the 30th Street Station complex.

SEPTA's Airport Line approaches this congested point of divergence from the east, crossing over the Corridor on a single-track flyover bridge that ramps down on the west side of the NEC at Phil Interlocking. Though the single-track flyover limits frequency of service on the Airport Line because it is shared by both northbound and southbound trains, it does prevent at-grade crossings of the NEC. However, northbound Wilmington/Newark trains do not have access to this flyover and must cross over the entire NEC main line at grade. These crossings require significant windows in Amtrak's schedule in both directions and can create traffic jams for all services. Improvements under consideration would expand the flyover and fully separate SEPTA's operations from Amtrak on the critical approach to 30th Street Station. These investments would reduce delays in and out of Philadelphia's major intermodal hub, increase scheduling flexibility, and create opportunities for growth in commuter service.

Center City Philadelphia

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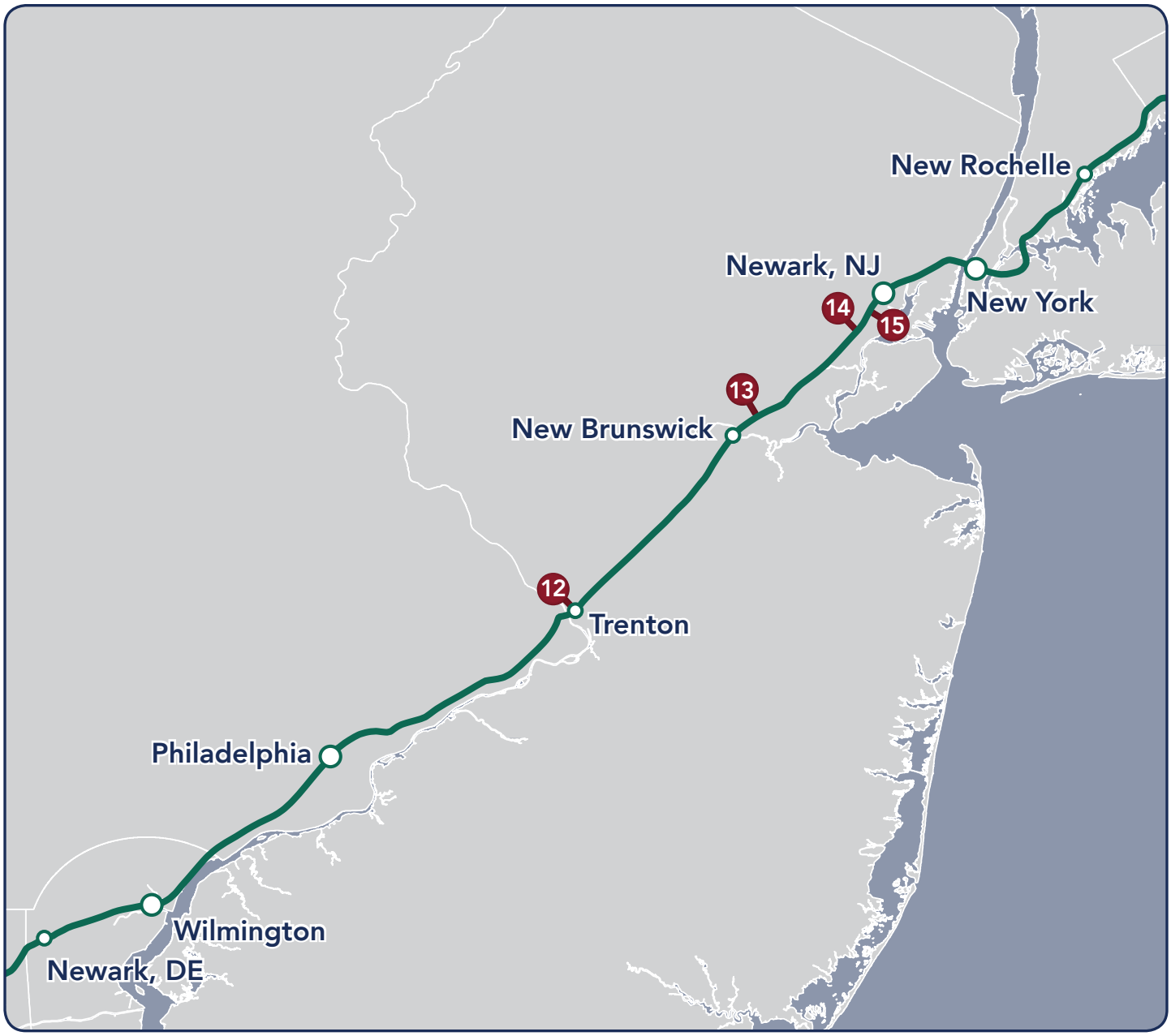
Philadelphia to Newark



12 Trenton Capacity Improvements

13 North Brunswick Loop

14 Elizabeth-Area Section Improvements

15 Hunter Flyover

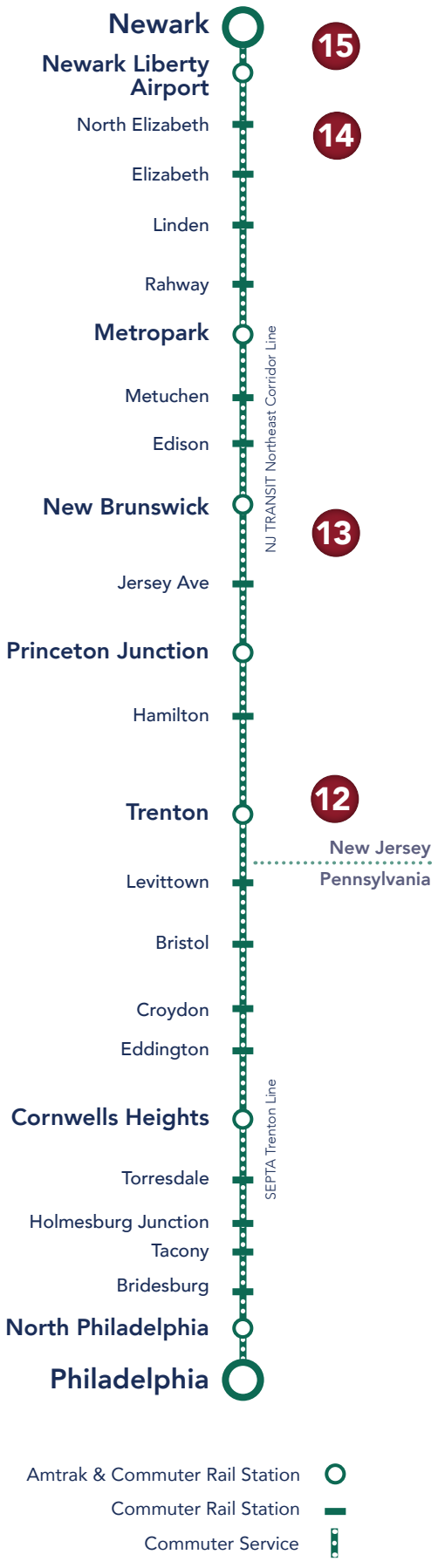
Philadelphia to Newark

The segment from Philadelphia to Newark, NJ, is approximately 81 miles long and is owned entirely by Amtrak. Amtrak runs its highest frequencies of service along this stretch and, as such, the segment is one of the busiest and most congested on the NEC. The segment is almost entirely a four-track railroad, except for two six-track sections in north-central New Jersey and a two-track approach to Philadelphia's 30th Street Station. In New Jersey, it includes some of the longest stretches of straight track on the NEC, which, by 2017, will allow for the highest speed operations on the NEC.

Commuter railroads provide service along the entire segment between Philadelphia's 30th Street Station and Newark Penn Station. From Philadelphia to Trenton, NJ, SEPTA operates its Trenton Line serving over 10,000 daily riders. SEPTA's Chestnut Hill West Line also operates along the NEC for a stretch between 30th Street Station and North Philadelphia. Between Trenton and Newark, NJ TRANSIT operates its Northeast Corridor Line (which extends to New York City) serving over 50,000 daily riders, as well as two additional lines (Raritan Valley and North Jersey Coast Lines) that join the NEC near Newark and Rahway, NJ, respectively. In addition, NJ TRANSIT operates the Atlantic City Line from 30th Street Station northward along an eight-mile stretch of the NEC. For freight traffic, both CSX and Conrail Shared Assets Operations (CSAO) operate on parts of the line.

The segment currently suffers from aging electrical infrastructure that is highly susceptible to failure. During the summer's periods of high heat, the overhead catenary wires are prone to sag and are occasionally snagged and pulled down by pantographs on moving trains, resulting in interrupted service along the line. In 2011, however, Amtrak was awarded a $450-million HSIPR grant to complete a major overhaul of a 22-mile stretch of the NEC in central New Jersey, which will modernize the electrical system dating back to the 1930s and upgrade track infrastructure to permit 160-mph Acela operations, making it the fastest section on the NEC.

As Amtrak plans to upgrade and expand its high-speed intercity service, however, the segment faces key capacity issues, particularly where commuter rail operations terminate or enter the NEC. The replacement of several critical at-grade interlockings with new grade-separated junctions would greatly reduce delays for riders. Major upgrades including additional main line tracks near Elizabeth, NJ would increase capacity and lower travel time. Targeted projects at Trenton Transit Center would support Amtrak's plans for 160-mph service while accommodating additional commuter service.



12 Trenton Capacity Improvements

Preliminary Engineering/ Environmental Analysis | Construction

Feasibility/ Conceptual Engineering | Final Design | Operation

Order-of-Magnitude Cost:

$350M

Overview: Trenton Transit Center forms the point of convergence of three major operators: Amtrak's NEC operations, SEPTA's Trenton Line, and NJ TRANSIT's Northeast Corridor Line, as well as occasional Conrail freight service. Each day, the station serves over 5,500 riders. As service has grown, the station's tracks and platforms have reached capacity. Their current configuration requires trains of either commuter operator to cross the entire NEC main line to access layover tracks or storage yards, or to switch service directions and serve opposite station platforms. In addition, SEPTA lacks overnight storage facilities and must send empty trains back on the Corridor, consuming scarce capacity.

Amtrak, NJ TRANSIT, and SEPTA have yet to formalize plans for improvements at the station. They will consider several investment strategies, which may include additional platforms and station tracks, a new storage yard, a flyover crossing, interlocking reconfiguration, and operational improvements.

13 North Brunswick Loop

©istockphoto.com/Ian Hamilton

Preliminary Engineering/ Environmental Analysis | Construction

Feasibility/ Conceptual Engineering | Final Design | Operation

Order-of-Magnitude Cost:

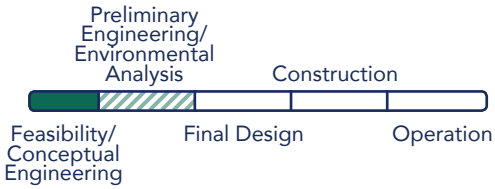
$200M

Overview: NJ TRANSIT's Northeast Corridor Line is the busiest line in the NJ TRANSIT commuter rail system. Almost half of the commuter trains on the line during peak hours begin or end at an intermediate point just outside of North Brunswick, NJ, at the location of a large storage yard. As trains leave the yard and enter the NEC main line toward New York, however, they must cross three tracks at grade. Trains require long gaps in service to make this complex crossing which reduces capacity on the Corridor. This configuration can also create delays for NJ TRANSIT trains waiting to enter the NEC and for Amtrak trains that must provide space for NJ TRANSIT.

To address this problem, NJ TRANSIT and Amtrak hope to construct a grade-separated flyover that would carry NJ TRANSIT trains up and over the NEC main line, along with a new "loop" track that would connect the yard to the flyover and serve a new commuter station for North Brunswick. These investments would reduce delays for riders and support expansion of service to a new station.

$100M | Complete | In Process | Next Step

14 Elizabeth-Area Section Improvements

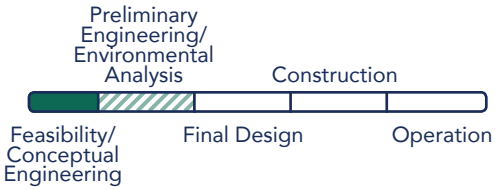


Overview: As the NEC traverses Elizabeth, NJ, the main line narrows from six tracks down to just four and follows a sharp reverse curve alignment through the downtown area. Currently, this stretch of track is at capacity, serving two NJ TRANSIT lines and all Amtrak NEC trains between New York and Philadelphia. It is one of the busiest portions of the NEC and, without additional capacity, no agency can add trains during peak hours.

A set of coordinated improvements to upgrade this section of the NEC through Elizabeth are under development. Proposed investments include a fifth NEC main line track and improvements to track alignment and interlockings. In addition, NJ TRANSIT plans to fund the construction of a new Elizabeth station facility that will dramatically upgrade passenger amenities and facilitate the future installation of a fifth NEC track. These investments would reduce delays and enable Amtrak and NJ TRANSIT to increase service.

Order-of-Magnitude Cost:

15 Hunter Flyover



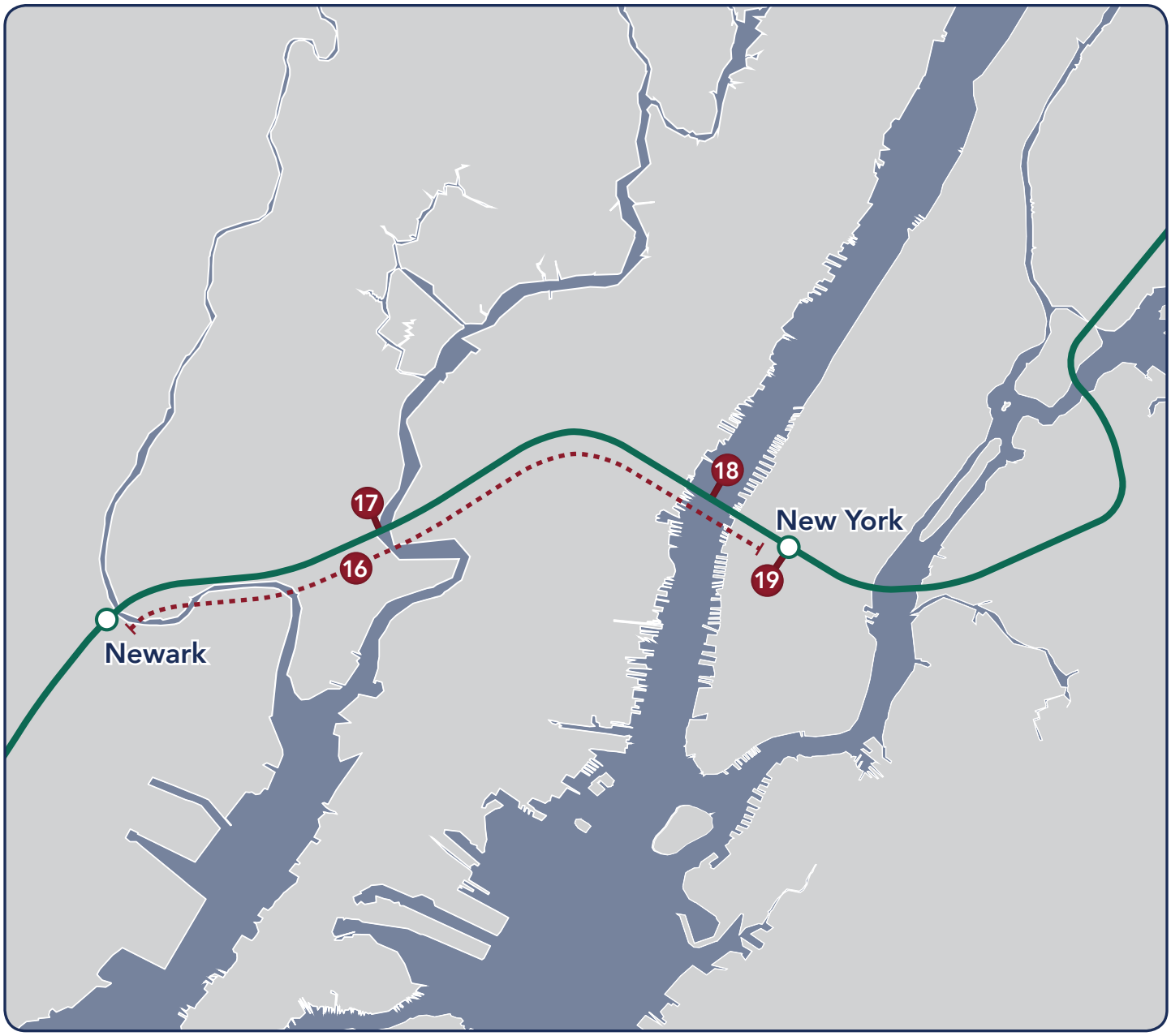
Overview: At Hunter Interlocking, the NJ TRANSIT Raritan Valley Line joins the NEC just west of Newark Penn Station. Currently, peak-hour Raritan Valley Line trains headed east to Newark must cross three to four NEC main line tracks at grade to access the eastbound tracks at Newark Penn Station. With forty Newark-bound trains per day, Raritan Valley Line trains create conflicts on one of the busiest stretches of the entire NEC. During the morning rush, Raritan Valley Line trains are often delayed as they wait for a "slot" to make the complex crossing, while Amtrak trains must occasionally wait for the trains to complete the crossing. To solve these issues, Amtrak and NJ TRANSIT intend to partner to construct the Hunter Flyover, which would carry Newark-bound Raritan Valley Line trains up and over the six-track NEC main line. This new flyover would remove many directional conflicts between trains and dramatically reduce delays for NJ TRANSIT and Amtrak.

Order-of-Magnitude Cost:

Rutgers University Campus in Newark, NJ

Arthur Paxton

Newark to New York



16 Highline Bridge Replacement & Newark to New York Fourth Track

17 Portal Bridge North & South

18 Hudson River Tunnels

19 Moynihan Station Phase Two & New York Penn Station Capacity Expansion

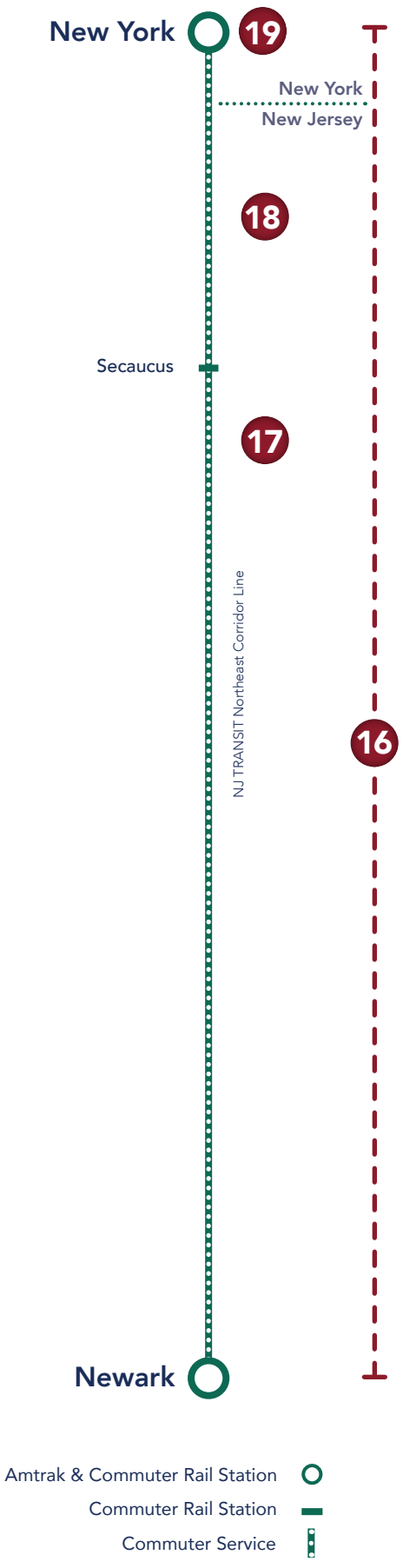
Newark to New York

The segment of the NEC between Newark and New York, NY is only ten miles long, but represents the most significant obstacle to increasing service on the entire NEC. Owned and operated by Amtrak, the segment is characterized by its superlatives. It is the most densely traveled stretch of railroad in the Western Hemisphere, carrying over 500 trains per day on just two tracks. At the same time, the segment also had one of the earliest railroad electrifications in the country, with its oldest major infrastructure components dating back to 1910.

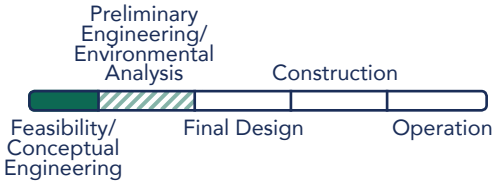
The segment is anchored by Newark Penn Station and New York Penn Station, the busiest passenger rail station in North America in terms of both passengers and train volumes. New York Penn Station is the main terminal for two commuter railroads: NJ TRANSIT and MTA Long Island Rail Road (LIRR). It also serves all of Amtrak's trains through New York City, including the Empire Corridor service between New York, Albany, and Buffalo, and several long distance routes. The segment serves as the only link between New York and the southern half of the NEC. Amtrak currently operates 100 daily trains between Newark and New York, while NJ TRANSIT operates four of its commuter rail lines (Northeast Corridor, North Jersey Coast, Morris & Essex, and Montclair-Boonton Lines) along all or parts of the segment, carrying over 150,000 daily riders on over 380 trains.

With infrastructure over a century old, the segment is a major bottleneck and is highly susceptible to service problems and delays that ripple throughout the Northeast. From Newark to New York, the NEC traverses the two-track Portal Bridge and a pair of single-track tunnels, both completed in 1910. With so few tracks, the segment operates at 100% capacity during rush hour with no room for error. A single service disruption can affect the entire NEC system. In 2011, for example, a slow-moving train had a minor derailment in one of the Hudson River Tunnels during the morning rush, causing delays as far away as Boston and Washington. The necessary repairs took twelve hours and services were impacted from that morning until noon the following day.

In 2011, Amtrak announced the Gateway Program, a series of investments aimed at addressing the capacity and reliability issues facing both NJ TRANSIT and Amtrak. Multiple efforts, including NEC FUTURE, will inform future plans to increase capacity between New York and New Jersey. Needs along this segment reflect the major components of Gateway, including Portal Bridge replacements, additional Hudson River tunneling, and station improvements in New York. Potential investments may include the Moynihan Station Project, which aims to create new passenger facilities for Amtrak in New York. Together, investments in these areas are required for any major increase in service for NJ TRANSIT and Amtrak and a reduction in delays for riders.



16 Highline Bridge Replacement & Newark to New York Fourth Track



Order-of-Magnitude Costs:

Highline Bridges

Fourth Track

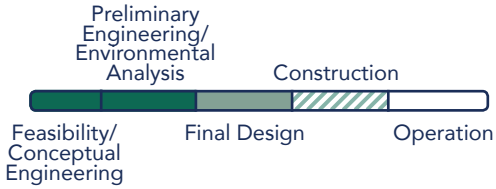
Overview: The "Highline" is the segment of the NEC that runs from Newark to the entrance of the Hudson River Tunnels. The Highline owes its name to the elevated embankment that carries the NEC tracks high above the wet marshes of the New Jersey Meadowlands. Currently consisting of just two tracks, the Highline – along with the existing Hudson River Tunnels and Portal Bridge – forms part of the most significant capacity bottleneck on the NEC.

Along the Highline, four bridges carry the NEC over the streets and rail lines that cross below the NEC. Over 100 years old, these bridges carry roughly 80% of the 500 daily trains that touch on the segment. They are exhibiting fatigue, cracking, and must be replaced. Plans call for removing the existing two-track bridges and constructing new four-track bridges, including the replacement of the unique "sawtooth" bridge that carries the NEC over the NJ TRANSIT Morristown Line and the PATH rail line.

Overall, Amtrak envisions completing a full four-track railroad along the length of the Highline by constructing two new tracks from Newark to the Hudson River Tunnels. A continuous third and fourth track would be essential to unlocking the full capacity gains promised by larger projects, including a new Portal Bridge and new Hudson River Tunnels. This additional capacity would enable both Amtrak and NJ TRANSIT to increase service and would greatly improve reliability by creating the flexibility to divert trains to alternative tracks when there are disruptions on the line.

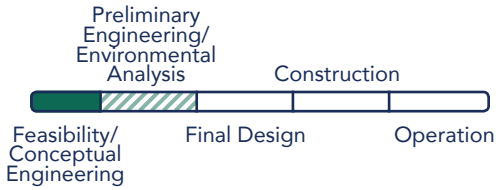
17 Portal North Bridge & Portal South Bridge

Portal Bridge North:



Estimated Construction Cost:

Portal Bridge South:



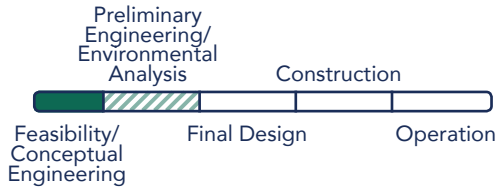
Order-of-Magnitude Cost:

Overview: Completed in 1910, the Portal Bridge carries the NEC over the Hackensack River between Kearny and Secaucus, NJ. The bridge earns the name "Portal" because it leads the NEC to the "portal" of the Hudson River Tunnels, located just three miles away. Portal is a movable swing bridge that is required by law to open for maritime traffic. Like most of the Newark to New York segment, the bridge carries only two tracks, creating a significant capacity bottleneck. The bridge is beyond the end of its design life, imposes high maintenance costs, and has become a major source of delays. Due to the advanced age of its components, the bridge will occasionally fail to lock into a closed position after it has swiveled open 90 degrees to allow boats to pass. As a result, all trains are delayed on this critical NEC segment while Amtrak maintenance forces make repairs. Since a serious malfunction in 1996, Amtrak has restricted speeds on the bridge to 60 mph (compared to 90 mph on the surrounding tracks).

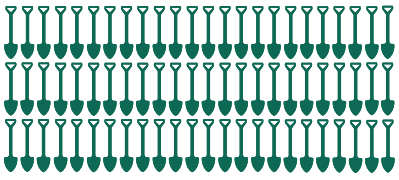
Two new bridges are planned or proposed to replace the existing Portal Bridge. The first new bridge, Portal North, is already in the final phase of design. In 2009, NJ TRANSIT completed environmental review, and in 2010, the agency was awarded a $38-million HSIPR grant to complete final design and engineering of the new bridge. Portal North will be a fixed two-track span constructed high enough to allow boats to pass freely below. Trains will face no bridge-imposed speed restrictions and will not have to wait for bridge openings. Final design is expected to be complete in the first quarter of 2013, after which the start of construction would await the availability of funding.

A second new bridge, Portal South, is proposed by Amtrak to complement Portal North and to enable Amtrak and NJ TRANSIT to decommission the existing unreliable Portal Bridge. Plans for the bridge would include the construction of a third and fourth NEC track, helping complete a four-track railroad between Newark and New York. Portal South would expand capacity and improve reliability by building flexibility into the system for crossing the Hackensack River.

18 Hudson River Tunnels



Order-of-Magnitude Cost:

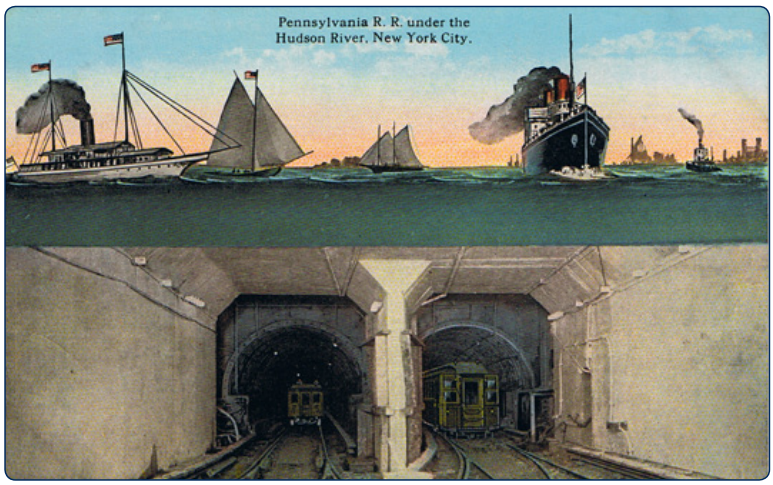


$7,200M

Overview: The biggest impediment to increasing service and improving reliability on the NEC is infrastructure crossing the Hudson River. The existing Hudson River Tunnels were an engineering marvel when they were completed in 1910. Over a century later, however, the current pair of one-track tunnels is woefully inadequate for current and future service.

Each of the two existing tunnels carry a maximum of twenty four trains per hour. During the morning and evening rush, there is simply no remaining capacity to add more trains. With just one track into New York and one track out, the current tunnels offer no system redundancy. When a train breaks down in one of the tunnels, service grinds nearly to a halt. Due to their age, the existing tunnels also require extensive maintenance and are in need of substantial repair. Without system redundancy, Amtrak is unable to make major investments in the tunnels without a major and ongoing disruption of service for both Amtrak and NJ TRANSIT.

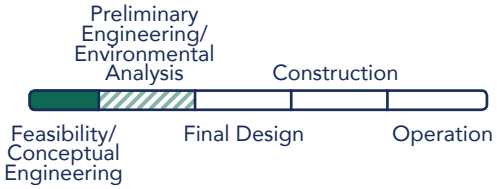
Multiple planning processes, including those by Amtrak and NEC FUTURE, are looking closely at the long-term capacity needs on the NEC with regard to capacity across the Hudson River. Future options may include a new pair of single-track tunnels, as is proposed by Amtrak's Gateway program. These new tunnels would nearly double the rail capacity between New York and New Jersey, enabling a substantial increase in both intercity and commuter service over many years to come. In addition, new tunnels would provide much needed system redundancy, keeping service moving smoothly even if an existing tunnel is taken out of service for regular maintenance or because of an unexpected service disruption.



A Vintage Post Card
of the Hudson River Tunnels.

19 Moynihan Station Phase Two & New York Penn Station Capacity Expansion

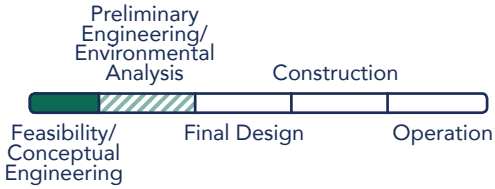
Moynihan Station Phase Two



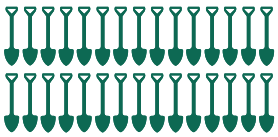
Order-of-Magnitude Cost:

$1,000M

Penn Station Capacity Expansion



Order-of-Magnitude Cost:



$3,000M

Overview: The existing New York Penn Station is the busiest passenger rail terminal in the United States, serving over 1,000 daily trains and almost 500,000 daily riders. Since the original Pennsylvania Station headhouse was demolished in the 1960s, the cramped design of the present-day underground Penn Station has been widely recognized as unfit to serve as the passenger rail gateway to America's most populous city. After the demolition of the original station, renowned architecture critic Vincent Scully famously remarked, "One entered the city like a god; one scuttles in now like a rat." Today, Penn Station's tracks, platforms, and waiting areas are regularly overwhelmed by the growing number of passengers boarding Amtrak, NJ TRANSIT, and LIRR trains.

Several complementary projects are planned or proposed to increase station capacity and upgrade the passenger experience in New York. First, the Port Authority of New York and New Jersey, in cooperation with Amtrak and LIRR, is leading the development of Moynihan Station, a new intercity passenger rail station that will dramatically improve the experience of boarding a train in New York. Located inside the historic Farley Post Office, just west of Penn Station and above the NEC tracks, the new station will offer a grand entrance to Manhattan and world-class facilities for intercity and commuter passengers. Phase One, already supported by state and federal funding, is expanding the site's underground concourse to improve track connections for Amtrak and LIRR. In Phase 2, above ground, the Farley Post Office will be converted into a full-scale, intercity passenger rail terminal, including the construction of ticketing facilities, waiting areas, retail amenities, and access points to tracks and platforms. When Phase 2 is complete, Amtrak's current station operations and primary boarding area would be relocated to Moynihan Station.

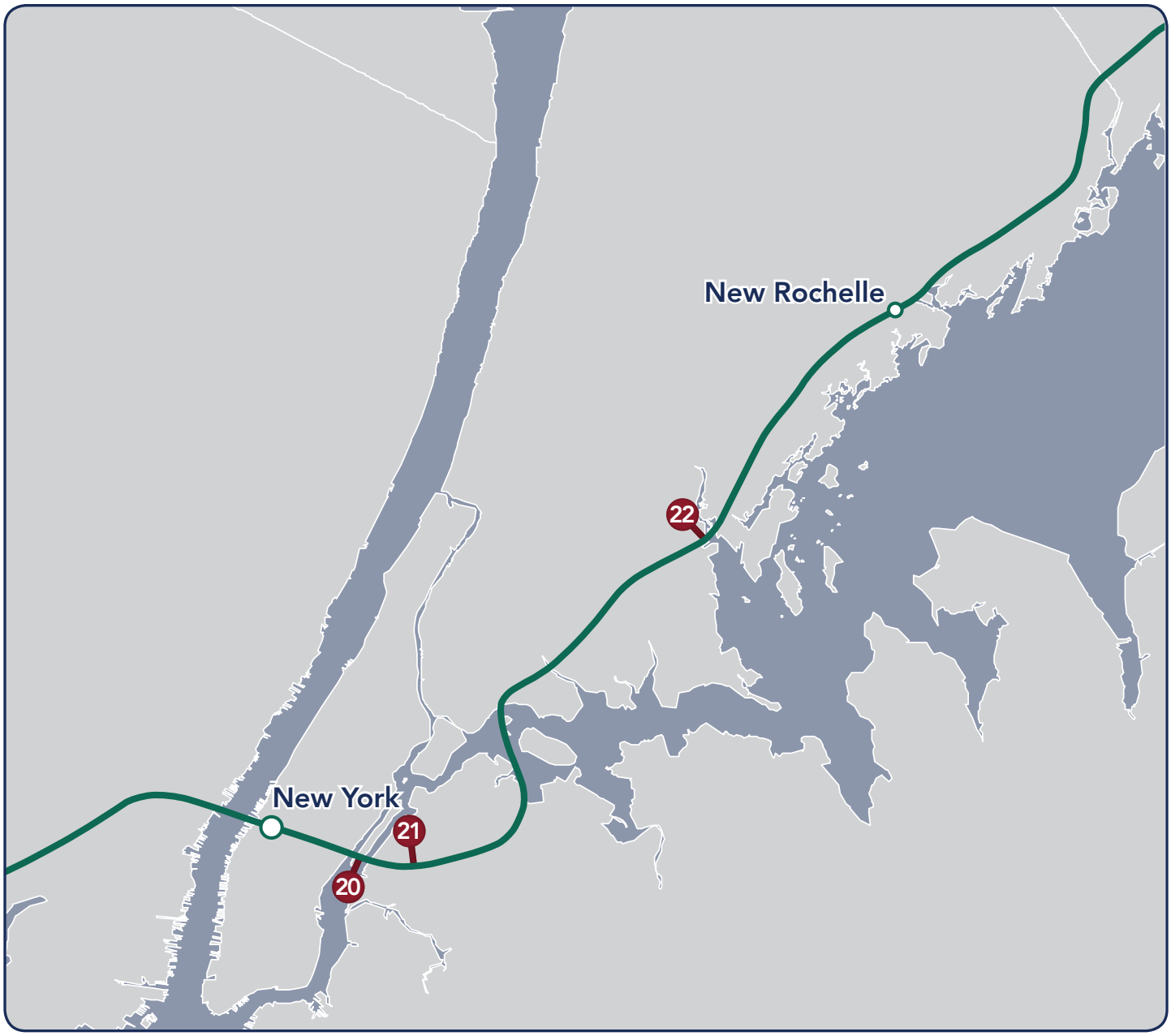
Second, as part of the larger Gateway program, Amtrak is proposing an expansion of New York Penn Station's track and platform facilities to increase capacity in New York. Plans under consideration include the construction of four new platforms and seven new tracks to accommodate the additional intercity and commuter services that would be made possible with new Hudson River tunneling.

Finally, Amtrak, LIRR, and NJ TRANSIT are considering architectural improvements to the existing New York Penn Station. The three agencies are currently completing a Penn Station master plan that could guide aesthetic and layout improvements aimed at upgrading and expanding the passenger waiting areas, creating new retail options, and making it easier to board trains and move through the station.

Midtown Manhattan

Florin Dr

New York to New Rochelle



20 East River Tunnel Track Replacement & Signal Upgrades

21 Sunnyside Yard Facilities Renewal and Service & Inspection Expansion

22 Pelham Bay Bridge Replacement

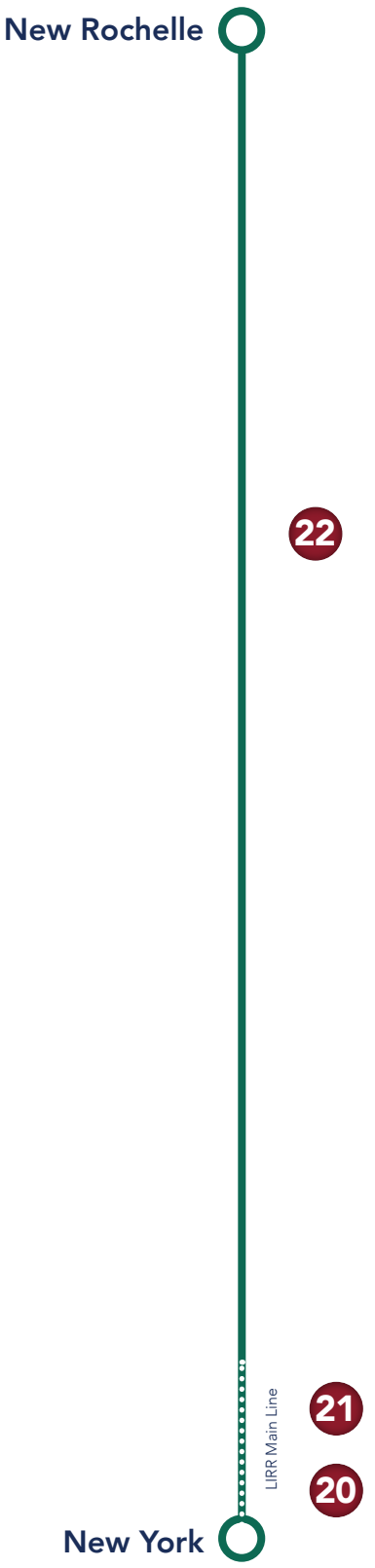
New York to New Rochelle

The segment of the NEC from New York City to New Rochelle, NY is the main rail gateway from NYC to Long Island and the northen half of the NEC. Amtrak owns the segment, supporting intercity service and high volumes of LIRR traffic for a brief stretch. The segment is 22 miles long and begins with four single-track tunnels under the East River between Manhattan and Queens. The section just east of the tunnels is the most operationally complex on the NEC, especially at Harold Interlocking, where the busy LIRR Main Line and Sunnyside Yard, a train storage facility, connect with the NEC. From there, the NEC heads to the Bronx and Westchester County, NY along the two-track Hell Gate Line, serving only Amtrak and freight trains with no station stops.

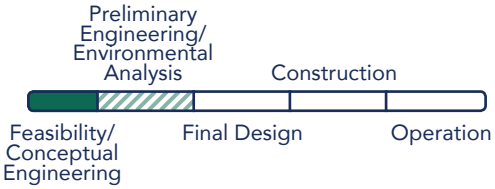
The four-track stretch of the NEC from New York Penn Station to Harold Interlocking is the busiest segment of passenger rail in the United States. In addition to Amtrak and LIRR, NJ TRANSIT trains use this stretch to access layover and storage facilities in Sunnyside Yard. In total, over 600 commuter trains and 48 Amtrak trains pass through Harold Interlocking every weekday, making it the most critical rail junction on the NEC. However, Harold Interlocking is a site of frequent delays for commuter and intercity passengers. In 2011, New York State was awarded a $295 million HSIPR grant to build a grade-separated flyover at Harold Interlocking to eliminate conflicts between Amtrak intercity and LIRR commuter trains and greatly reduce delays.

On the New Haven Line, which currently departs the NEC at New Rochelle and sends all Manhattan-bound trains to New York's Grand Central Terminal, Metro-North hopes to begin providing commuter service into New York Penn Station via the Hell Gate Line after the completion of the East Side Access Project. However, with this additional commuter service, the NEC Master Plan projected that virtually the entire 22-mile segment would be operating at maximum capacity in 2030. The East River Tunnels are already congested during rush hour. Despite high demand, outdated signal systems in the East River Tunnels require unnecessarily large gaps between trains, effectively reducing capacity. In addition, the Hell Gate Line relies on the Pelham Bay Bridge, a century-old asset that must be replaced.

The critical needs along this segment focus on increasing capacity and achieving a state-of-good-repair to boost reliability. In the East River Tunnels, investments in the signal system and track structures would provide a way to run additional trains while improving on-time performance. A re-built Pelham Bay Bridge would improve train speeds and potentially add capacity for future service expansion. Upgrades at Sunnyside Yard would improve the efficiency of this major shared use facility for NJ TRANSIT and Amtrak while creating space to accommodate proposed increases in Amtrak service.



20 East River Tunnel Track Replacement & Signal Upgrades

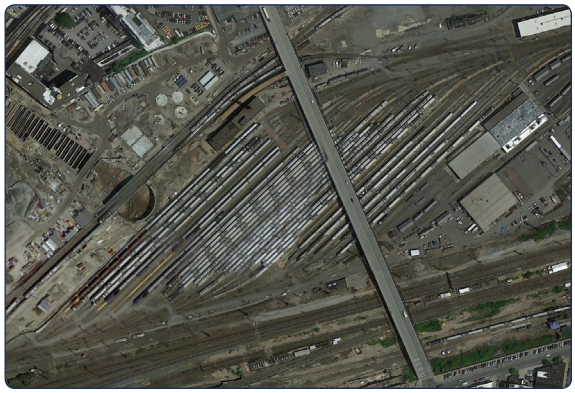


Order-of-Magnitude Cost:

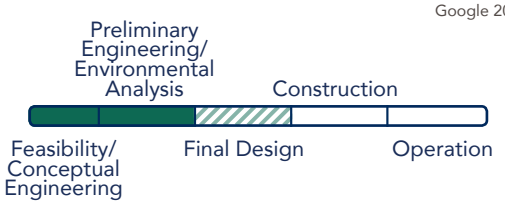
Overview: The East River Tunnels form the connection between New York Penn Station, Long Island, and the northern half of the NEC. The tunnels are comprised of four single-track tubes between Manhattan and Queens, and are shared by scheduled Amtrak and LIRR passenger services, as well as empty Amtrak and NJ TRANSIT trains heading to and from Sunnyside Yard in Queens. Constructed in 1910, the tunnels carry over 600 daily trains, making the tunnels and the route to Sunnyside Yard the busiest stretch along the entire NEC.

Amtrak and LIRR are currently engaged in modernizing the East River Tunnels. Investments are needed to reline the drainage system and replace the track structure, which currently require extensive ongoing maintenance. Additional investments would replace its aging signal system, which is prone to failure and delays, with a modern high-density signal system that is capable of allowing higher-frequency service. The new system would increase capacity, reduce delays, and improve safety by supporting the implementation of positive train control technology.

21 Sunnyside Yard Facilities Renewal and Service & Inspection Expansion



Google 2012

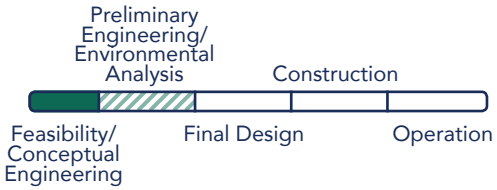


Order-of-Magnitude Cost:

Overview: Sunnyside Yard is one of the most critical equipment servicing and storage yards on the entire NEC. Located in Queens, NY, the yard is the starting point for many of the Amtrak and NJ TRANSIT trains that begin their journey at New York Penn Station. On average, 47 Amtrak trains and 28 NJ TRANSIT trains are serviced, inspected, or stored in Sunnyside every day. The existing yard has no weather-protected facility for servicing conventional (non-Acela) trains and lacks the capacity necessary for the expected growth in train service on the NEC, including potential increases in high-speed service.

Amtrak is currently developing a master plan for Sunnyside Yard to assess the current and future needs of both Amtrak and NJ TRANSIT. Plans for Sunnyside include options for increased capacity for servicing high-speed trains, new high-speed and conventional train storage, and new service, inspection, and repair facilities for conventional trains. Investments would enable Sunnyside to support increased service for Amtrak, while continuing to support NJ TRANSIT storage and servicing needs.

22 Pelham Bay Bridge Replacement



Order-of-Magnitude Cost:

Overview: The Pelham Bay Bridge is a two-track movable bridge that carries the NEC over the Hutchinson River in the Bronx, NY. While the bridge primarily serves Amtrak NEC trains, CSX and Providence & Worcester Railroad use the bridge for light-density freight traffic. In the future, MTA Metro-North Railroad is proposing to use the bridge for a Hell Gate Line service sending some New Haven Line trains to New York Penn Station along the NEC in the Bronx and Queens.

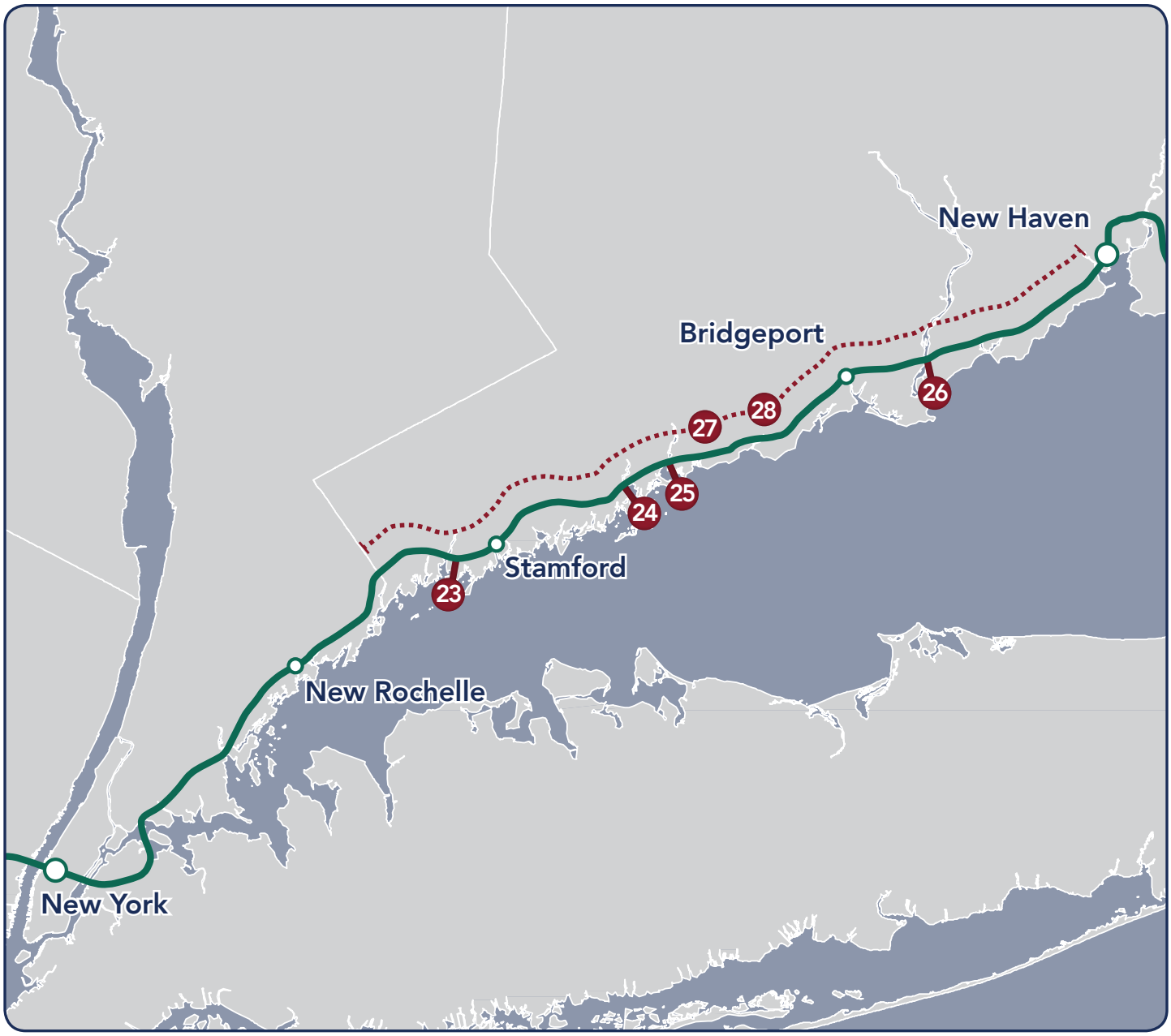
Completed in 1907, Pelham Bay Bridge has reached the end of its useful life and requires extensive ongoing maintenance. Its obsolete and aging components have forced Amtrak to restrict speeds to just 45 mph. The bridge has a lift span that is manned by a bridge operator. It opens several times per day for commercial boats and occasionally faces minor problems closing properly.

Amtrak plans to replace the bridge with a new high-level fixed bridge that will offer enough clearance for boats to pass below. A new fixed bridge will increase reliability and may offer opportunities to increase capacity for Amtrak and proposed Metro-North service.

Gary Pancavage

Hell Gate Bridge in New York City

New Rochelle to New Haven



23 Cos Cob Bridge Replacement

24 Norwalk River Bridge Rehabilitation

25 Saugatuck River Bridge Rehabilitation

26 Devon Bridge Replacement

27 New Haven Line Catenary and Bridge Replacement Program

28 New Haven Line Communication and Signal Upgrades

New Rochelle to New Haven

From New Rochelle to New Haven, CT, the NEC travels along the New Haven Line, which is controlled and dispatched by Metro-North Railroad, a division of the New York MTA. Ownership of the New Haven Line is split between the MTA and Connecticut at the state line. Traveling from New York Penn Station, Amtrak NEC trains merge with the Metro-North New Haven Line trains at New Rochelle. The segment is approximately 56 miles and is primarily four tracks, with a short three-track section in Milford, CT.

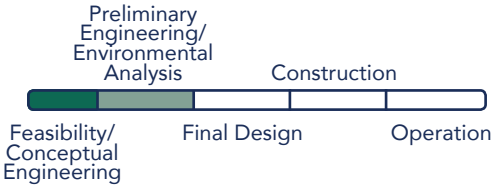
The New Haven Line is the busiest single commuter rail line in the United States. In addition to Amtrak's 42 intercity trains between New Rochelle and New Haven, Metro-North operates 345 daily commuter trains between New York's Grand Central Terminal and locations in New York and Connecticut. The line carries over 80,000 daily commuters along its NEC portion and more reverse-commuters than any other commuter rail line in the country. Both CSX and Providence & Worcester operate freight trains on stretches in both states.

The New Haven Line has over two dozen bridges including five major movable bridges in the state of Connecticut, all but one of which are in critical need of replacement or rehabilitation to address state-of-good-repair, reliability, and capacity issues. The oldest of these bridges was completed in the late 1800s. Over time, their physical structures have deteriorated, leading to mechanical problems that increase maintenance costs and disrupt service.

The segment also suffers from aging electrical and signal systems, many of which were first constructed in the early 20th Century. These systems are unreliable, technically obsolete, and increasingly prone to failure. In high temperatures, for example, the line's overhead catenary wires tend to sag, forcing trains to reduce speed to avoid damage. On some occasions, trains get tangled in the lowered wires and tear them down, resulting in massive delays for commuters and intercity travelers.

Proposed investments along this segment include replacing aging catenary, power supply, and signal systems, and rehabilitating or rebuilding its major bridges. These investments would dramatically improve reliability and ensure its viability well into the future. The state of Connecticut is currently devoting considerable funding to programs to replace aging catenary, electric power supply systems, signal systems, and bridges. Due to the constraints of the state's capital budget, however, significant funding gaps remain.

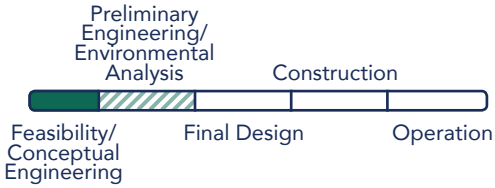
23 Cos Cob Bridge Replacement



Estimated Construction Cost: TBD

Overview: Cos Cob Bridge is 1,089-feet long and carries four New Haven Line tracks over the Mianus River in Greenwich, CT. Of the major movable bridges on the New Haven Line, Cos Cob is the busiest. The bridge is comprised of twelve steel spans, with a movable segment at its center that lifts to allow boats to pass below. The bridge was constructed in 1904 and received some rehabilitation in 1989. However, this bridge now requires substantial investment to address challenges caused by aging components and deferred maintenance. ConnDOT has contracted a consultant to perform an engineering feasibility study that is identifying near-term repairs to address service reliability and maintenance issues, as well as long-term alternatives for replacement or rehabilitation. The results of this feasibility study will be complete in summer 2013 and will inform the estimated construction costs for this potential long-term work.

24 Norwalk River Bridge Rehabilitation

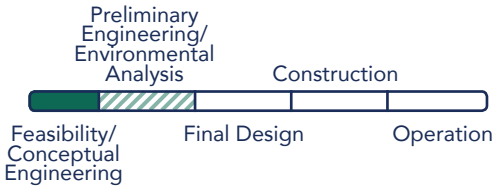


Estimated Construction Cost:
(Reflecting inflation at the expected mid-point of construction)

Overview: The Norwalk River Bridge is 562-feet long and is a four-track swing bridge in Norwalk, CT. One of only two swing bridges on the NEC, the bridge was constructed in 1889. Its original swing span is still in operation today. Since its construction, the bridge has experienced increasing deterioration. Age and deferred maintenance have damaged both the electrical and mechanical components of the bridge. ConnDOT hopes to complete a full rehabilitation of the existing bridge to improve reliability and decrease congestion on the New Haven Line. Currently proposed work includes rehabilitation of the tracks approaching the bridge, structural repairs to the bridge itself, and upgrades to the bridge's mechanical and electrical systems.

25 Saugatuck River Bridge Rehabilitation

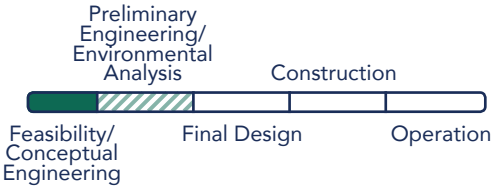
Overview: The Saugatuck River Bridge is a 458-foot-long bascule bridge constructed in 1904. The bridge is actually not one, but two parallel bridges, each carrying two tracks. Like the Norwalk River Bridge, its age and deferred maintenance have caused deterioration encompassing both its electrical and mechanical components. ConnDOT is aiming to fully replace major components of the bridges, including the movable spans and the approach tracks. This work would also include the replacement of mechanical and electrical systems, new signal equipment, and a new operator's house. This new bridge would greatly improve reliability for Amtrak and Metro-North riders, as well as maritime traffic.



Estimated Construction Cost:
(Reflecting inflation at the expected mid-point of construction)

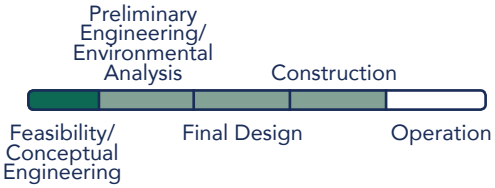
26 Devon Bridge Replacement

Overview: The Devon Bridge is 1,067-feet long and carries four New Haven Line tracks over the Housatonic River between Stratford and Milford, CT. The bridge is comprised of seven spans, with one that opens in the center. The bridge was constructed in 1905 and underwent rehabilitation in 1990. Like the state's other movable bridges, Devon has experienced severe deterioration. In 2010, ConnDOT funded a feasibility study to examine the engineering needs on the bridge and options for improvement. The study recommended a full replacement of the bridge, as well as short-term repairs to ensure reliability and safety. In 2012, ConnDOT initiated construction on these short-term repairs.



Estimated Construction Cost:
(Reflecting inflation at the expected mid-point of construction)

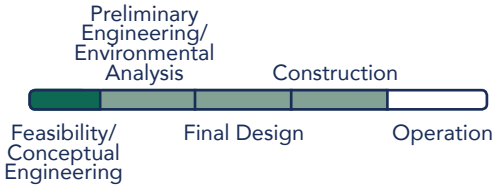
27 New Haven Line Catenary and Bridge Replacement Program



Order-of-Magnitude Cost:

Overview: The state of Connecticut is leading an ongoing program to replace aging power system components, catenary, and smaller bridges on the New Haven Line. Separate from the state's major movable water-crossing bridges, this program's work addresses state-of-good-repair issues on the many bridges that carry the New Haven Line over roads and other crossings below the railroad. The program's catenary replacement is installing a constant-tension catenary system that prevents overhead electrical wires from sagging or tightening during changes in temperature, a major contributor to reliability problems. Finally, work on the line's power system will replace all historic, oil-filled circuit breakers at Connecticut's substations with a state-of-the-art system. ConnDOT's five-year capital plan currently has $375 million in state funding dedicated to these efforts, though a significant funding gap remains.

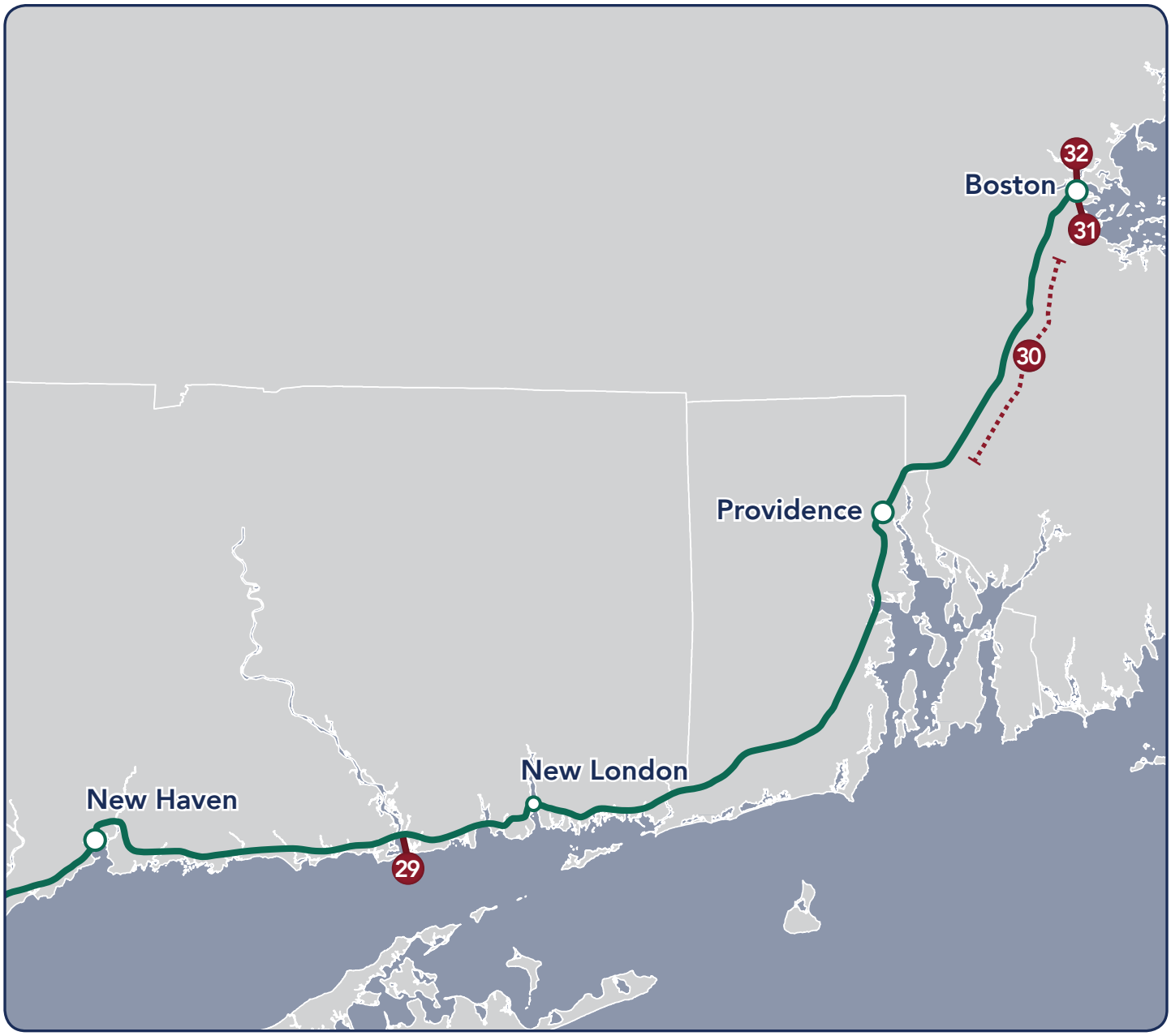
28 New Haven Line Communication & Signal Upgrades



Order-of-Magnitude Cost:

Overview: The state of Connecticut is also leading a program to upgrade communications and signal systems on the New Haven Line. This work will replace existing signals inside the engineer's cab with a technology-driven solution that is upgrade-able in the long term. This improvement will increase the efficiency of train operations, increase train speeds, and add capacity to the railroad. ConnDOT's five-year capital plan currently has $10M in state funding dedicated to this effort, also leaving a significant funding gap.

New Haven to Boston



29 Connecticut River Bridge Replacement

30 Massachusetts Third Track

31 Boston South Station Improvements

32 Southampton Yard Capacity Expansion

New Haven to Boston

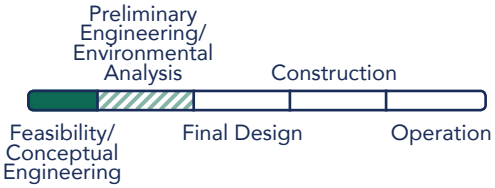
The segment of the NEC from New Haven to Boston, MA is approximately 158 miles. Compared to other sections of the NEC, elements of this segment are in a relatively good state of repair, thanks to a major project in the 1990s that electrified and upgraded the segment in preparation for the introduction of Acela service. Amtrak owns the 120 miles of this segment in Connecticut and Rhode Island, and Massachusetts owns the northernmost 38 miles within its borders. Amtrak controls train operations and maintains infrastructure over all 158 miles. The segment is primarily a two-track railroad, with sidings and three- and four-track segments in key areas. Amtrak, Shore Line East, and the Massachusetts Bay Transportation Authority (MBTA) all operate passenger service on the line, along with freight service by CSX and Providence & Worcester.

Despite recent investments, the segment still relies on several aging assets and suffers from chokepoints that cause reliability problems and preclude service expansion to meet even short-term growth needs. The Connecticut portion closely follows the Long Island Sound shoreline and must compete with marine traffic at the locations of three movable bridges. The Thames River Bridge was replaced in 2008 and the Niantic River Bridge was replaced in 2012. The Connecticut River Bridge, however, still stands at over 100 years old and requires reconstruction. Shore Line East operates 23 commuter trains along this segment between New Haven and Old Saybrook (with two daily trains farther east to New London) in addition to all Boston-bound Amtrak trains.

The most significant chokepoint on this segment occurs at Boston South Station. Amtrak and MBTA operate over 320 passenger trains into and out of South Station on an average weekday. Many of the MBTA trains leave the NEC for other lines soon after departing South Station. However, 36 weekday trains on MBTA's Providence Line operate exclusively on NEC track to Providence, RI. Some MBTA trips were extended to T. F. Green Airport west of Providence in late 2010. As of April 2012, 20 trains per weekday operate farther west to a new station at Wickford Junction.

Critical needs along this segment include replacing the Connecticut River Bridge, adding additional track capacity in Massachusetts, and upgrading stations facilities in Boston. A Connecticut River Bridge project would improve reliability of both rail and marine traffic. Track projects in Massachusetts would extend a third NEC main line track through most of the state. A major expansion of Boston South Station – currently undergoing planning and environmental review under the leadership of MassDOT and MBTA, with funding from the FRA – would address existing congestion and allow for commuter and intercity service growth. Planning for an associated storage facility in Boston is also underway and would increase the rail network's overall efficiency.

29 Connecticut River Bridge Replacement

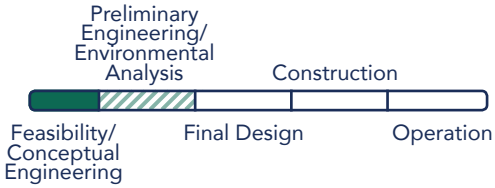


Order-of-Magnitude Cost:

Overview: The Connecticut River Bridge, between Old Saybrook and Old Lyme, CT carries Amtrak and Shore Line East trains. Completed in 1907, it is the oldest movable bridge on this segment. A span in the middle tilts up to allow boats to pass. By law, the bridge must remain open from May through September for recreational boats to pass and close for a limited number of trains each day. The marine environment is corroding the bridge's steel and, due to these structural conditions, speeds are restricted to 45 mph. Many key elements of the bridge have reached the end of their design life and require extensive maintenance to remain in operable condition. The frequent opening and closing of the bridge – over 3,000 times per year – puts high demands on its aging components, increasing maintenance costs for Amtrak.

Amtrak currently plans to replace the Connecticut River Bridge. Design and configuration of a replacement bridge would aim to improve reliability and offer higher speeds for Amtrak and Shore Line East trains.

30 Massachusetts Third Track



Order-of-Magnitude Costs:

Sharon to Attleboro Third Track:

Readville to Canton Third Track:

Overview: In Massachusetts, the NEC comprises three tracks near Boston, but constricts down to just two tracks near Route 128 Station. This two-track configuration for the remainder of Massachusetts creates a significant capacity bottleneck for Amtrak and MBTA's Providence Line, which together run 61 trains daily between Boston and Providence. To support existing services and proposed expansions, additional three-track territory would be required through Massachusetts. Two areas of critical need are 12 miles from Sharon to Attleboro and five miles from Readville to Canton Junction. Each section of additional track would significantly expand capacity along the NEC in Massachusetts, enabling Amtrak and MBTA to improve and increase service.

31 Boston South Station Improvements

Preliminary Engineering/ Environmental Analysis

Construction

Feasibility/ Conceptual Engineering

Final Design

Operation

Order-of-Magnitude Cost:

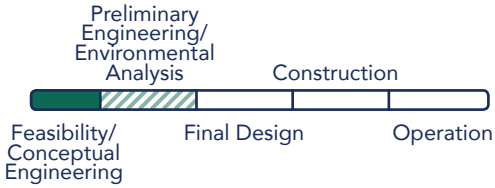
$650M

Overview: Boston South Station is the anchor of the northern half of the NEC, serving Amtrak and eight lines on the busy MBTA commuter rail system. With over 320 daily trains, South Station serves some of the highest daily train volumes in North America – second only to New York Penn Station on the NEC. South Station is currently operating at capacity, creating a significant bottleneck and a major obstacle to increasing service. Due to limited space at the nearby Southampton Yard, trains are stored on station tracks, eating up the already scarce capacity. For passengers, the station's tracks are exposed to the elements, forcing riders to travel through rain, snow, and cold temperatures to reach their trains.

MassDOT and MBTA are initiating planning on the Boston South Station Expansion Project. In 2010, the state was awarded a $35-million HSIPR grant to complete preliminary engineering and environmental analysis. The project is expected to dramatically increase capacity at the station. Plans may include new tracks and new passenger facilities, as well as additional storage space for MBTA trains. Improvements would build upon the station's existing architectural legacy, creating a superior passenger experience and supporting the growth of MBTA and Amtrak service.

32 Southampton Yard Capacity Expansion

Google 2012



Overview: Southampton Yard is the primary storage location for Boston South Station, providing maintenance and inspection for 16 Amtrak trains per day as well as storage for several MBTA trains. Southampton Yard includes a service shop for Acela trains, and service and inspection facilities for conventional (non-high-speed) trains. The current yard is at capacity and will be unable to accommodate future increases in service. To address the existing constraints at Southampton, plans under development by Amtrak would increase the yard's capacity for the storage and servicing of trains. These investments would enable Amtrak and MBTA to expand service. This planning complements the South Station Expansion Project in examining solutions to increase storage capacity for MBTA at Boston South Station.

Order-of-Magnitude Cost:

$60M

Kenmore Square and Back Bay, Boston

Corridor-Wide Needs

Corridor-Wide Needs

In addition to investment needs on specific segments, the NEC is in need of improvements that span multiple segments or, in some cases, the entire line from Washington to Boston. Improvements in major categories – like bridges, electrical systems, signals, and stations – are essential to addressing delays and service failures up and down the Corridor.

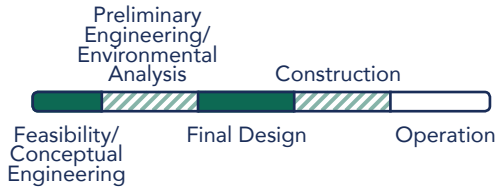
One of the most pressing needs along major parts of the Corridor is the rehabilitation of the line's electrical and signaling systems, which have deteriorated in many areas or have become obsolete. These systems are a major source of delay for both Amtrak and commuter trains. Segments of overhead electrical catenary wire and other major components date back to 1930 and are unreliable and ill-equipped to meet present-day service needs. The overhead electric catenary tends to sag in hot temperatures, creating hazardous conditions where pantographs can snag the wire and pull down the catenary structure. In addition, the electrical system often struggles to keep up with the demand of today's high volume of train traffic. The system occasionally experiences dips in voltage that can stop service on the line. The signaling system's aging components are similarly unreliable. Signal malfunctions at major stations, like New York Penn Station, can back up dozens of trains as they try to enter and leave the station during the busy rush hour.

Some work has already been completed to address these challenges. Along the northern half of the NEC, the catenary between New Haven and Boston was installed in the late 1990's and remains in good repair. Significant work on other parts of the Corridor remains. ConnDOT is currently in the middle of a multi-year project to replace the catenary and signals on the New Haven Line but faces future funding gaps. In 2011, Amtrak received a $450-million grant for comprehensive upgrades along a 22-mile stretch of the NEC in New Jersey, including catenary and signal work. Outside of this project, however, aging electrical and signal systems continue to plague the remainder of the NEC between Washington and New York.

Many of the NEC's large structures, including bridges and stations, require major investment to ensure the long-term reliability and growth of rail service. In addition to the larger bridges described by geographic segment, the Corridor relies on dozens of small bridges, many almost a century old, that are in need of accelerated replacement. While the station projects described earlier in this report represent significant capacity bottlenecks, other stations that do not require large-scale expansion have critical needs to ensure a safe, comfortable, and reliable experience for riders. Some structures have benefited from programmed investment in the 1980s and 1990s, but the NEC has since experienced significant ridership growth, creating additional needs.

These programmatic infrastructure investments that overhaul electrical systems that power trains, upgrade control centers that manage train dispatching, rehabilitate dozens of smaller bridges, and bolster station facilities would dramatically improve the reliability of train service and ensure the viability of the NEC for generations to come.

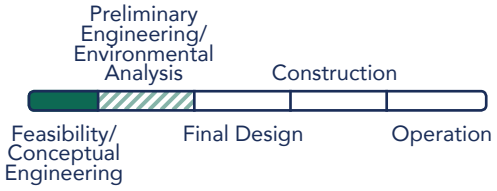
33 Undergrade Bridges



Overview: While the NEC relies on several large movable bridges which must be replaced or repaired, it also relies on hundreds of smaller, stationary bridges. These shorter bridges carry the NEC over the smaller rivers, roadways, and other natural or manmade features that cross below the Corridor. Many such bridges are over a century old and in need of significant rehabilitation or replacement. The vertical clearance below many of these bridges is insufficient. They are occasionally struck by moving vehicles which can disrupt service. Along the NEC, Amtrak and the Northeast states recognize a need to repair or replace numerous spans to improve reliability and, in certain cases, expand capacity for future service. While the rehabilitation of most such bridges is ready for preliminary engineering, the rehabilitation or replacement of a subset of bridges is ready for construction.

Order-of-Magnitude Cost:

34 Signal & Control Systems

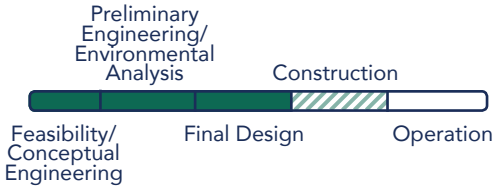


Order-of-Magnitude Costs:

Overview: Just like traffic lights on the road, signal systems are essential to the safe and efficient movement of trains along the Corridor. Between New York and Washington, however, the NEC relies on signal systems installed before World War II that are now antiquated and limit capacity. A signal malfunction on one section of the NEC can impede trains movements on other sections of the Corridor – an occurrence all too frequent during the busy rush periods. Amtrak intends to systematically upgrade its signal system between New York and Washington with a modern "high-density" signal design that enables trains to safely operate at higher speed and frequency. This new system would greatly improve reliability and increase capacity for Amtrak and commuter railroads.

At its three centralized train control centers, Amtrak manages the signal systems to dispatch trains Corridor-wide, with the exception of Metro-North's New Haven Line. These facilities control the movement of both Amtrak and commuter trains, and maintain safe and efficient operations, particularly at congested terminals like Boston South Station and New York Penn Station. Over time, train control programming at these centers has become outdated. Amtrak intends to update control centers in Boston, Wilmington, and New York with the latest in train control technology, making them better equipped to manage today's traffic and prepared for future increases in service.

35 Catenary & Power Supply Systems



Order-of-Magnitude Costs:

Catenary Upgrades Washington, DC - NYC

Power Supply

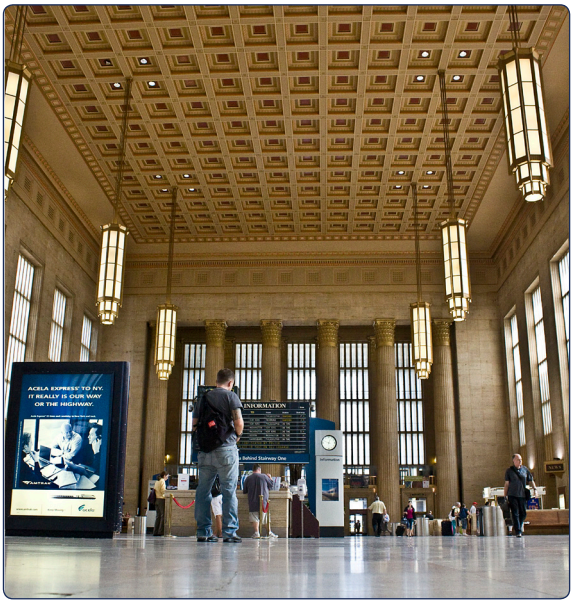
Overview: The vast majority of NEC trains are powered by electricity. A complex system of overhead wires, called "catenary," carry power over the tracks, while "substations" located at key points on the line connect the catenary to the regional power grid. As trains move, "pantographs" – mechanical arms on top of each train — draw electricity from the catenary to power the engine.

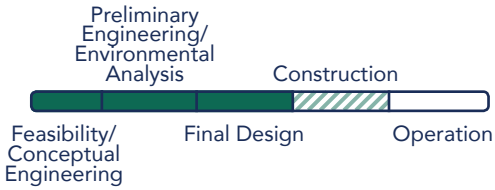
Both catenary wires and the power supply system are in need of investment. Like many components of the NEC, portions of the catenary wires date back to the 1930s and are extremely susceptible to failure. During extreme heat, the wires tend to sag. Fast-moving pantographs can become tangled in the catenary wires and tear them down, stopping all trains on the track. These events create major delays for riders and can cause significant damage to the system. Trains travel at slower speeds during high temperatures to avoid this situation. The solution to this problem is modern "constant-tension" catenary that keeps wires taut at any temperature.

On the southern end of the NEC, Amtrak is planning to substantially replace direct-fixation catenary with constant-tension catenary. The new system would greatly improve reliability and enable Amtrak to increase speeds of its high-speed service in key locations. In 2011, Amtrak won a $450-million grant to begin work on new catenary and other improvements on a 22-mile stretch of the NEC in New Jersey, which will increase current Acela Express top speeds from 135 to 160 mph — making it the fastest stretch on the NEC. Between Boston and New Haven, constant-tension catenary was constructed in the 1990s to prepare for the introduction of Acela Express service. Between New York and New Haven, the state of Connecticut is in the process of replacing the catenary system but faces significant funding gaps while it aims to complete work by 2017.

The NEC's electrical substations are also in need of investment. Spaced strategically along the line, substations are necessary to convert electricity to the frequency used by trains. Over time, many of the components at each substation have deteriorated, undermining the reliability of the system. To ensure the NEC maintains a consistent and reliable source of power, Amtrak aims to make improvements at several key points on the line. This work would include the rehabilitation of several existing substations and the replacement of several transmission lines that serve them.

36 NEC Stations





Estimated Design and Construction Costs:

NEC Station Lighting & Repairs:

$80M

Baltimore Penn Station Repairs and Improvements:

$50M

Philadelphia 30th Street Station Repairs and Improvements:

$60M

Providence Station Repairs and Improvements:

$40M

Overview: Amtrak and the NEC commuter railroads aim to continuously improve the rider experience at NEC stations. In 2009, Amtrak was awarded an ARRA grant that funded upgrades to the lighting systems on all platforms served by its Acela Express services. This work benefited not only Amtrak passengers, but all riders at these stations. Amtrak intends to build on this work by replacing the remaining platform lighting at major NEC stations, including New York Penn Station, Philadelphia 30th Street Station, Baltimore Penn Station, and Washington Union Station, while also making targeted repairs to the platform structures.

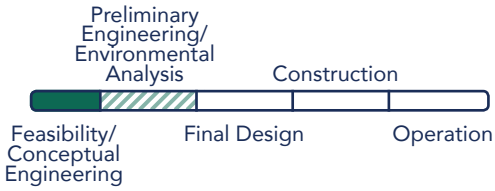
In addition to these investments and to the larger-scale projects at the major hubs of Washington, New York, and Boston, the following stations have specific needs:

Baltimore Penn Station serves as the through rail hub of the city of Baltimore, serving Amtrak and the MARC Penn Line. Officials have identified a set of high-priority investments to improve the passenger experience and support expanded train operations. Investments would include the redesign and reconfiguration of passenger facilities and track layout at the station, as well as key structural improvements to the station, including the roofing, flooring, and heating and air-conditioning systems.

Philadelphia 30th Street Station serves over 29,000 daily SEPTA and Amtrak passengers and, for Amtrak, is the third busiest stop on the NEC. Completed in 1933, the station is perhaps the "crown jewel" of Philadelphia's transportation system and is listed on the National Register of Historic Places. Despite its historical prominence and aesthetic value, the station's façade has begun to deteriorate, creating a serious safety concern for the railroad and the users of the station. Amtrak officials are proposing a $60-million project to repair the station's stone façade, which would ensure its structural integrity and restore its 1930s grandeur.

Providence Station, a relatively modern facility, opened in 1986 with a realignment of the NEC through the downtown. However, the building has not received a significant upgrade since that time. The station serves Amtrak and the MBTA/RIDOT Providence Line between Boston and Wickford Junction. Amtrak and the city of Providence propose investments to upgrade the station building and its surroundings, while bringing the station structure and the rail tunnel serving the station, located at the base of the Rhode Island State House, to a state-of-good-repair. Proposed investments would also include improving elevators and stairs, fire safety facilities, and connections for transit riders and pedestrians. This work would enhance the passenger experience and ensure the long-term reliability of service at the station.

37 NEC Track Stabilization, Ride Quality, and Drainage Program



Order-of-Magnitude Costs Corridor-Wide: TBD

Order-of-Magnitude Cost in Maryland:

$250M

Overview: Safe and reliable rail operations depend on highly engineered and stable roadbed conditions that provide a comfortable ride even when traveling at higher speeds. Geological conditions such as soil type and groundwater flow combined with weather conditions can, over time, de-stabilize the roadbed and right-of-way that support the NEC. Locations near open-water shorelines, such as northeastern Maryland and Connecticut, are known to be locations with such challenges due to the presence of water undermining the below-track structure.

A ballast cleaning program is needed to address mud spots on all main tracks on the NEC. Culverts and ditches that carry water away from the track are aging and must be cleaned, repaired, or replaced. Rock cuts must be widened to remove decades of rockslide accumulations and allow the use of modern maintenance machinery. Similarly, slopes above and below the tracks must be stabilized to prevent slides from damaging the right-of-way. These investments would preserve the longer-term reliability of passenger and freight service, improve ride quality, and reduce the chances of unexpected service disruptions.

Glossary

American Recovery & Reinvestment Act of 2009 (ARRA)

Legislation signed by President Obama on February 7, 2009 that provided $8 billion in grants to complete planning and/or implementation of improvements to passenger rail service on federally-designated passenger rail corridors through the High-Speed & Intercity Passenger Rail (HSIPR) program.

At grade

Railroad tracks or roads and railroad tracks that cross at ground level. When a train crosses another set of tracks at grade, it momentarily blocks other trains from using those tracks. Conversely, an underpass, tunnel, or flyover allows a train to cross other tracks without passing through them, thereby ensuring free flow of traffic on both sets of tracks.

Backlog

Rehabilitation or replacement work that has not been covered by regular maintenance. Typically includes major bridge or tunnel assets that are beyond their anticipated lifespans.

Capacity

The number of trains (and/or riders) that can pass through an area in a certain period of time (e.g. trains per hour), depending on the quantity and configuration of tracks. A section of rail is said to be "at capacity" when it can accommodate no additional trains during busy hours. For example, both of the single-track tunnels below the Hudson River carry their maximum of twenty-four trains per hour during peak travel times.

Catenary

Electrical wires suspended above railroad tracks from which passing trains draw power using a mechanical arm called a pantograph mounted on top of a train.

Commuter rail

Passenger rail service that carries riders over medium distances (typically 10 – 75 miles), often between suburban locations and urban cores with highest frequencies during morning and evening rush hours. Commuter rail can share track and stations with, but is distinct from, intercity rail, which operates over longer distances and generally runs at lower frequencies. Commuter rail is also distinct from rail rapid transit (subway or metro), which operates on separate track facilities over shorter distances. Commuter rail services on the NEC include VRE, MARC, SEPTA, NJ TRANSIT, Long Island Rail Road, Metro-North Railroad, Shore Line East, and MBTA.

Connecting corridor

Rail corridors on which trains branch off from and flow into the NEC main line between Washington and Boston. Examples include corridors from Richmond, VA (connecting at Washington); Harrisburg, PA (connecting at Philadelphia); Albany, NY (connecting at New York); and Springfield, MA (connecting at New Haven).

Conventional rail

Intercity trains that travel at speeds of 125 mph or slower. Though definitions of conventional and high-speed rail vary, for the purposes of this report, all non-Acela Express Amtrak trains that operate on the NEC (i.e. Northeast Regional, Keystone, etc.) are referred to as conventional rail.

Federal Railroad Administration (FRA)

The federal agency responsible for oversight of the nation's railroads. FRA is a division within the U.S. Department of Transportation. The agency sets standards for safety and performs other regulatory duties. It also oversees the HSIPR Program, which has funded improvements to portions of the nation's railroad network served by passenger trains.

Flyover

A form of bridge that carries one or more tracks up and over another set of tracks. Flyovers enable trains to cross over a set of tracks without interfering with the movement of trains below.

Freight rail

A form of rail service that principally carries materials other than passengers, such as consumer goods and industrial commodities. Freight rail operators on the NEC include Conrail Shared Assets Operations, CSX Transportation, Norfolk Southern and the Providence & Worcester Railroad.

Grade-separated

Railroad tracks or roads and railroad tracks that cross without intersecting. Underpasses, flyovers, bridges, or tunnels allow all traffic to move freely, without conflict.

High-Speed & Intercity Passenger Rail Program (HSIPR)

A program authorized by the Passenger Rail Investment and Improvement Act of 2008 (PRIIA) and launched by FRA in June 2009 to make strategic upgrades to the nation's passenger rail network. The program solicited applications for more than $10 billion in available funding from ARRA and annual appropriations in FY 2009 and 2010. The Program has funded some projects through planning and engineering phases, and others through final design and construction.

High-speed rail

Intercity trains that travel at speeds of 125 mph or greater. Though definitions of high-speed and conventional rail vary, for the purposes of this report, only Acela Express Amtrak trains that operate on the NEC are referred to as high-speed rail.

Intercity rail

Passenger rail service that carries travelers over longer distances (typically 100 – 500 miles), often between major urban centers. Examples of intercity rail services on the NEC include Amtrak's Northeast Regional and Acela Express trains serving major cities and stations between Washington and Boston.

Interlocking

A place on a railroad where one or more tracks converge, diverge, or cross, controlled by signals to prevent conflicting movements of trains. An interlocking may be where a connecting line joins a main line, where a railroad adds to or subtracts from its number of main line tracks, or simply where a railroad enables trains to switch between tracks.

Main line

The core line of the NEC, which runs between Washington Union Station and Boston South Station via New York Penn Station.

Movable bridge

A bridge that carries railroad tracks over a body of water that is required to open for boat traffic to pass. A movable bridge may be a "swing bridge," where a segment swivels 90 degrees to create an opening, or a "bascule bridge," where a span tilts up to allow passage.

Normalized replacement

Regular renewal of basic system components, such as railroad ties, to ensure safe operation. Does not include major projects such as bridge or tunnel replacements.

Pantograph

A mechanical arm mounted on top of an electricity-powered train that draws power from overhead catenary wires.

Project stage

The specific phases or steps in a project's development from initial conception to completion.

Feasibility / Conceptual Engineering
The earliest stage of project planning where problems are defined, potential solutions are developed, and any fatal flaws that might preclude a proposed solution are identified. This stage broadly outlines proposed improvements for additional analysis.

Preliminary Engineering / Environmental Analysis
The project stage where engineers generate more detailed designs and conduct more thorough analyses of proposed improvements. Projects are sufficiently defined to allow planners and engineers to estimate its likely impact on the surrounding environment. To ensure compliance with the National Environmental Policy Act (NEPA), projects are reviewed for effects on both natural and manmade resources, covering issues ranging from wildlife and air quality to community and social justice.

Final Design
The stage where engineers determine the ultimate designs and specifications for constructing improvements, including more precise estimates of construction cost.

Construction
The stage in which improvements are built.

Operation
The stage in which improvements support enhanced service.

Reliability

The degree to which trains operate according to their scheduled departure and arrival times.

Service and Inspection (S&I) facility

A shop located at a rail yard where trains are monitored and maintained to ensure safe, reliable, and efficient operations.

Signals

A system used to control the movement of trains on a railroad to ensure safe distances and prevent collisions.

State-of-good-repair

A condition in which an asset or assets are regularly maintained and there is no backlog of replacement projects.

Substation

Electrical system facility that connects the railroad's catenary to the regional power grid.

Undergrade bridge

A small railroad bridge that allows creeks, roadways, and other natural or manmade features to pass below tracks.

Yard

An area consisting of a network of tracks where trains are stored and/or maintained.

Appendix

Current Projects on the NEC Main Line

Supported by federal funding programs on top of Amtrak's annual federal appropriations

Project Name[1]	Program[2,3]	Federal	Non-Federal	Total Funding
Corridor-wide Investments				
Northeast Corridor FUTURE	HSIPR	$10	NA	$10
Targeted Investments				
Boston South Station Expansion Project (PE/NEPA)[4]	HSIPR	$33	$11	$43
Providence Improvements (PE/NEPA)	HSIPR	$3	$1	$4
Kingston Track Capacity and Platform Improvements	HSIPR	$26	NA	$26
Stamford Intermodal Access	TIGER	$11	$28	$39
Harold Interlocking	HSIPR	$295	$74	$368
New York Moynihan Station Phase I	Multiple	$274	$50	$323
Newark, NJ Portal Bridge	HSIPR	$39	$17	$55
Trenton-New Brunswick Signal, Track, Catenary Improvements	HSIPR	$450	NA	$450
Delaware Third Track	Multiple	$38	$15	$53
Newark Regional Transportation Center	TIGER	$10	$16	$26
Newark Train Station Improvement Plan	TIGER	$2	$1	$3
Susquehanna River Bridge Replacement (PE/NEPA)	HSIPR	$22	NA	$22
Baltimore and Potomac Tunnels (PE/NEPA)	HSIPR	$60	NA	$60
BWI Airport Station (PE/NEPA)	HSIPR	$9	NA	$9
Washington Union Station Escalators	HSIPR	$4	$4	$9
TOTAL		**$1,286**	**$217**	**$1,500**

Notes

(1) List does not include projects funded through Amtrak's annual capital program or American Recovery & Reinvestment Act of 2009 (ARRA) grants made directly to Amtrak outside the HSIPR program. (2) HSIPR refers to the federal High-Speed Intercity Passenger Rail program, which is administered by the Federal Railroad Administration and was funded through ARRA and federal appropriations in fiscal years 2010 and 2011. (3) TIGER refers to the Transportation Investment Generating Economic Recovery program, or TIGER Discretionary Grant Program, which is administered by the U.S. Department of Transportation. (4) PE/NEPA refers to preliminary engineering and environmental impact analysis required by the National Environmental Policy Act of 1970 (NEPA).

End Notes

1. U.S. Census Bureau. 2011. *2010 U.S. Census, Summary File 1*. Washington, DC.

2. Bureau of Labor Statistics, U.S. Department of Labor. 2011. Regional Economic Accounts. *Gross Domestic Product by Metropolitan Statistical Area, 2010*.

3. Fortune Magazine. 2011. *"Fortune 500 2011: Annual ranking of America's largest corporations."* [http://money.cnn.com/magazines/fortune/fortune500/2011/index.html] Accessed: July 2012.

4. Schrank, D., Lomax, T., and Eisele, B.. 2011. *Texas Transportation Institute's 2011 Urban Mobility Report, Powered by INRIX Traffic Data.* Texas Transpotation Institute. Texas A&M University System.

5. United States Government Accountability Office. 2010. *GAO-10-452. National Airspace System: Setting On-Time Performance Targets at Congested Airports Could Help Focus FAA's Actions.* Report to the Committee on Commerce, Science, and Transportaton, U.S. Senate. Washington, DC. May 2010. P. 28.

6. Central Japan Railway. 2012. *Annual Report 2012*. Tokyo, Japan.

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Page 47: Hell Gate Bridge in New York City, Gary Pancavage. Courtesy of Gary Pancavage and Amtrak.

Cover photos

Front cover: Portal Bridge, Kearny, NJ. Courtesy of Amtrak.
Back cover: Philadelphia 30th Street Station. Courtesy of Amtrak.

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